Making and Understanding Embarras Bipoints: The Replication and Operational Sequencing of a Newly Defined Stone Tool from the Eastern Slopes of Alberta.

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Abstract

At pre-ceramic archaeological sites, projectile points are the primary diagnostic tool used by archaeologists. This reliance is even more pronounced along the eastern slopes of Alberta and boreal forest environments of Canada. The acidity of the soils, cryoturbation, and other transformative factors almost always destroy all but the most durable cultural material. In order to obtain the best understanding of precontact lifeways under these conditions we need to recognize and appreciate the diagnostic qualities of all lithic artifacts not just projectile points. The main goal of my thesis will be to look at one such artifact type. In Alberta, predominantly along the eastern slopes, there have been a number of new and unique artifact types recovered from the cultural resource management studies that have been carried out for several forestry companies, oil and gas operations, and coal industries. The one of particular interest for this thesis will be the Embarras Bipoint (Meyer et al. 2002, Meyer 2003; Roe 2005a, 2005b).

I intend to look at the geographical and temporal distribution of Embarras Bipoints. At present, Embarras Bipoints have been assigned to the Early Middle Period (7,500 to 5,000 B.P.). I will compile a data set of other large stone tools to compare to Embarras Bipoints. The theoretical approach will be chaîne opératoire which will be supplemented by the experimental replication of Embarras Bipoints. Ultimately, this technological study of Embarras Bipoints will demonstrate that when found in isolation, in the absence of diagnostic projectile points, or in any un-dateable context have the diagnostic qualities to further our understanding of the Early Middle Period along the Eastern Slopes of Alberta.

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To my beautiful, loving, supportive, wife Lesley, you are my BEST! I never would have accomplished this without you. Your indefatigable confidence in me and the unbounding patience you have shown my rock obsession are only two of an infinite number of reasons why I love you.

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Table of Contents

List of Tables

Appendix A

List of Figures

List of Plates

Chapter 1
Introduction

The genesis of this thesis grew out of the Historical Resource Management projects I have been involved with for forestry companies whose Forest Management Areas are located along the Eastern Slopes of the Rocky Mountains of Alberta. One of the interesting phenomenon, which persists even to this day from this work, is the minimal recovery of diagnostic artifacts that could be used to relatively date some of the sites being found. However, from a number of sites we have recovered a number of large bifacially worked quartzite tools. Initially these quartzite bifaces were seen as typical bifaces found almost anywhere in Alberta and beyond. When our (Dan Meyer and myself) frustrations from not finding diagnostics increased we decided to go back and re-examine these bifaces. It was not long before it became obvious that these tools were not typical, random bifaces and we identified them as Embarras Bipoints. The identification of Embarras Bipoint as a new tool type led to a literature search of known sites in and around the study area and the recognition of and conclusion that a number of similar stone tools had been found but identified only as bifaces. Was this just a huge coincidence? Were these artifacts diagnostic? What time period did they belong to? How wide a distribution do these tools have? What were they being used for? All of these questions arose immediately and as our Historical Resource Impact Assessment (H.R.I.A.) work and literature review proceeded, the more apparent it became that some of these questions should be dealt with.

1.1. Introduction to research problem

Projectile points are one of the most diagnostic artifacts found at Precontact Period archaeological sites on the Northern Plains and along the Eastern Slopes. In too many cases, if there is a lack of projectile points then there difficulties assigning temporal and spatial parameters to archaeological assemblages. This has led to a search for ‘other’ diagnostic stone tools that can fill in when projectile points can not. One such artifact types is the Embarras Bipoint. There a myriad of questions that need to be addressed about Embarras Bipoints and the role they played in the past. This is because Embarras Bipoints have only begun to be recognized as potentially diagnostic. Also, the Eastern Slopes of Alberta have had very little archaeological research done especially compared to other areas, such as the Plains. This thesis will address only a few of these questions and hopefully establish Embarras Bipoints as artifacts that are important to our increased understanding of Alberta’s past. The main questions I will deal with are ‘How are they made?’, ‘Do the techniques used to manufacture these tools make them diagnostic?’, ‘Where are Embarras Bipoints found?’, and ‘What temporal context do these tools have?’. In a small way, I will also address the question of what these tools used for. The goal of this thesis will be to orient all my findings towards answering these questions.

1.2. Chapter layout

The thesis has been laid out in the following fashion. *Chapter one* is an introduction to the thesis, providing the groundwork on what to expect in the rest of the thesis. An overview of the Early Middle Period is provided in *Chapter two*. *Chapter three* is a discussion of the chaîne opératoire approach and how it relates to Embarras Bipoints. *Chapter four* looks at Embarras Bipoints, the raw materials used to make them, and the characteristics that make them unique. *Chapter five* is the compilation and analysis of other large bifacial and unifacial stone tools that can be compared to Embarras Bipoints. *Chapter six* is the experimental and replicative work done for this thesis. *Chapter seven* addresses the results of experiments. *Chapter eight* is a summary of the thesis where I draw some conclusions about Embarras Bipoints.

1.3. The Reasons This Thesis is Important

There are a number of different reasons why this thesis is important. First, projectile points from the Early Middle Period have a lot of variability and variety. This is not bad because what are consider projectile point ‘types’ may not be as important or rigid in the Early Middle Period as at other time periods or that the people making the projectile points were more concerned with manufacturing a functional tool rather than a formalized type or style. Another possibility could be that archaeologists have not completely figured out the culture history of the Early Middle Period. So, looking at the other stone artifacts from this period may help to fill in the diagnostic holes that projectile points just cannot do.

Another reason this thesis is important, especially along the Eastern Slopes, is the amount of faunal materials recovered is negligible when compared to other geographic areas such as the Plains. Consequently, obtaining a radiocarbon date and/or organic tools can be difficult. By creating and establishing a wider variety of diagnostic tools, we can increase the chances of being able to date an archaeological site.

A third reason this thesis is important is that it provides an opportunity to learn about and better understand the Early Middle Period. The focus on a different artifact category, as opposed to projectile points, scrapers, bones, or ceramics, will increase and diversify what can be learned about the Early Middle Period. Also, there may be attributes of these ‘other’ artifacts that will not be found on stone tips and end scrapers that allow for a broader spectrum understanding of the Early Middle Period.

1.4. Theoretical Approach

The theoretical approach(s) to be explored throughout this thesis come from the anthropology of techniques, more specifically chaîne opératoire. The reason that this approach will work best is, “[t]echniques mediate between things and society and it is precisely for this reason that the ethnoarchaeological study of technologies leads in so many directions, towards apprenticeship and craft transmission, the organization of production, trade and exchange, style and the expression of social boundaries, gender and ideology” (David and Kramer 2001:146-46). To supplement this approach I have undertaken replication. I believe in, “communities of practice” (Whittaker 2004:173) and therefore will try to use chaîne opératoire and replication in a more ethnoarchaeological fashion. Also, this approach is focused on the lithic artisans of the Early Middle Period who, I believe, were semi-specialists, and because of the community of practice concept, there should be some analogous compatibility. The chaîne opératoire approach of material culture is more appropriate for ethnoarchaeological research where ethnographic data is available. Obviously, a modern analogy to material culture that dates to the Early Middle Period will be tenuous but the focus will primarily be on the technology and when possible the cultural context of Embarras Bipoints.

1.5. Study Area

The geographical area that will be the focus of this study is the Eastern Slopes of Alberta more specifically, the Hinton/Robb area being the core (See Figure 1.1). This stems from the H.R.I.A. work I have been involved in as well as a familiarity with the area. Supplemental research has been done and will include peripheral areas further to the south (i.e. the Waterton area) and east (i.e. the Calgary Area).

Defining the boundaries of the study area was done for several reasons. There has been very little archaeological research done along the Eastern Slopes, especially when compared to other geographical regions such as the Plains. From the known archaeological sites in this area, the Early Middle Period appears to be relatively well represented and provided an ample data set to work with. Restricting the focus to this area means more attention could be given to Foothills data, with the understanding that archaeological material outside the study area may be relevant. Lastly, the hope has been to demonstrate that Embarras Bipoints are a Foothills phenomenon.

Geographically and environmentally this area is diverse. There are a number of important waterways through the area, such as the Athabasca River, McLeod River, Pembina River, Cardinal River, Wildhay River and the Berland River that would allow people to move around the area. There are also a number of large standing bodies of water, for example Brule Lake, Rock Lake, Fairfax Lake, Pepper Lake, Fickle Lake, and Obed Lake that would provide fish and other littoral resources. There are three major ecological zones, or ecotones, within the study area. The different ecotones include the Rocky Mountains to the west, the Plateau and Foothills (which are different than foothills to the south for example around Longview), and the Edson Lowlands, Hightower Creek, and Oldman Creek areas of the forested plains to the east.

The biodiversity of the area would have been a draw for people to live in this area. The Plateau and the Oldman Creek areas, for example, are relatively open environments, even today, and during the Early Middle Period when it was warmer and drier would have provided more grassland resources. The mountains, only a short distance to the west, provided resources not found elsewhere. The forested areas have floral and faunal resources supplemental to living in the area. The more open grassland areas would have been a draw for large game such as bison, elk, and Grizzly bear. The forested and marshy areas would provide habitat for deer, moose, and Black bear. Throughout there would be smaller animals such as wolf, coyote, fisher, mink, weasel, wolverine, skunk, beaver, rabbit and various rodents. The wetland environments would

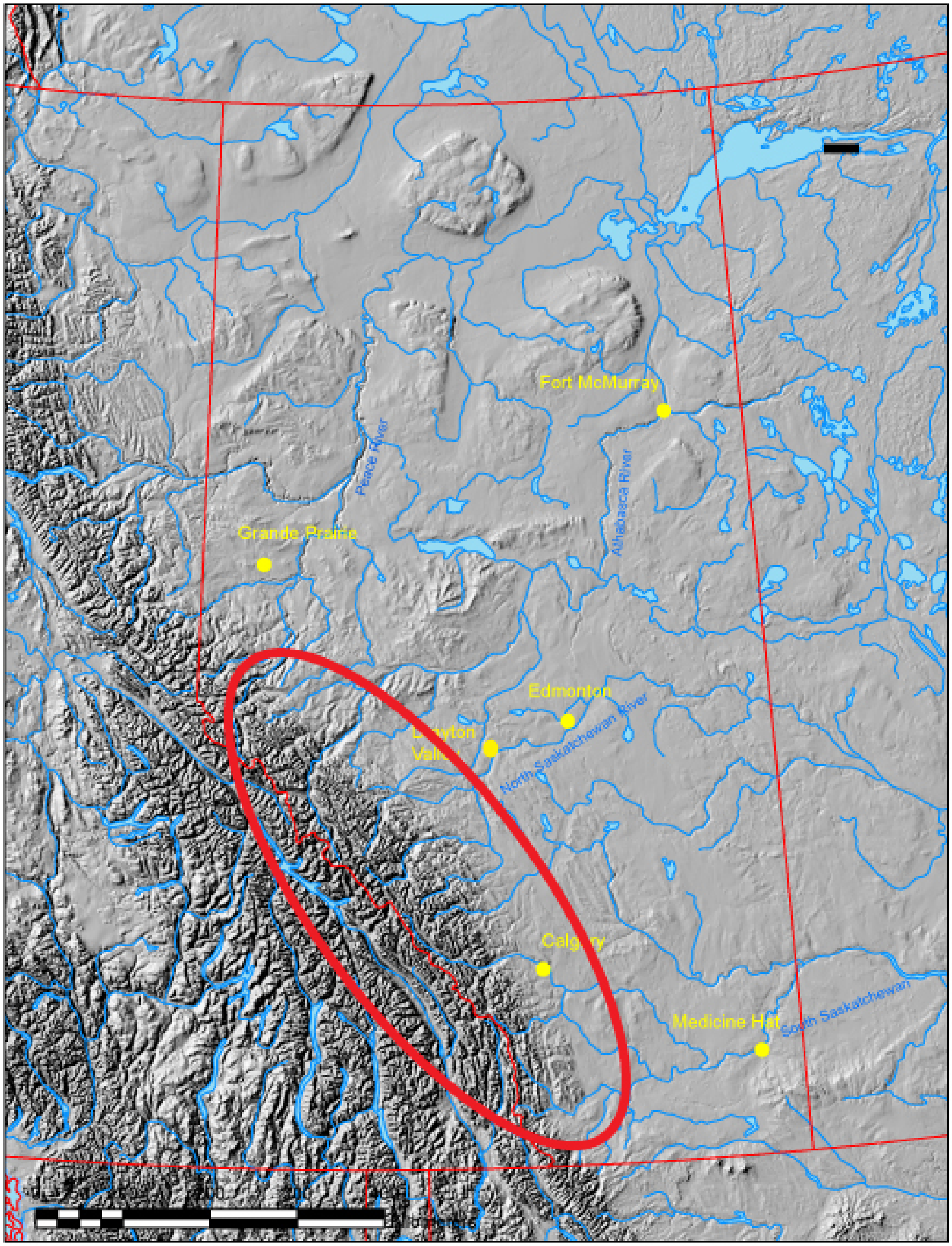

Figure 1.1: Map of Study Area

provide a variety of fish, frogs, lizards, snakes, and various waterfowl that would include a variety of ducks, geese, loons, and herons. Raptors, crows, ravens, magpies, nuthatches, and jays would have made this mixed environment their home.

Most importantly, there is a resource, high quality, fine-grained quartzite that I believe was either keeping people in the area or making them come back on an annual or semi-annual basis. The source of this quartzite is not localized to one or a few specific locations but available on a regional basis. Further discussion of this toolstone can be found in Chapter four.

1.6. Culture History

One of the first questions to be asked is where do Embarras Bipoints belong in the culture history of the Eastern Slopes of Alberta (see Figure 1.2). With only a few radiocarbon dates available, an absolute range of dates makes any definitive conclusions tentative. Also, the scant number, and the varied forms, of projectile points and other diagnostics are such that a direct association with any one particular type is at this time still tenuous. The projectile points that have been found with Embarras Bipoints are all from the Early Middle Period. This time period covers a 2,500-year stretch of time and many tool styles can be in fashion and disappear from a cultural milieu within such a vast stretch of time. Also, there is still no absolute consensus on the types of projectile points characteristic to this period. This will be discussed in Chapter two.

1.7. Site Assemblages

One of the main sources of data for the chaîne opératoire study of Embarras Bipoints will be the Upper Lovett Campsite, FgQf-16, a site excavated in 2005-2006. However, an important aspect of this thesis will be the use of other archaeological sites to make up the assemblage of tools to be studied. The reason for this is that only a few of the archaeological sites have been excavated in my study area. Of the few sites that have been excavated most of the field technicians, analysts, and/or report authors did not recognized Embarras Bipoints as a distinct tool type. This means I had to search out artifacts that appeared to have characteristics of Embarras Bipoint, analysing them, then reinterpreting as Embarras Bipoints if they meet the criteria discussed in Chapter four. Lastly, another reason to examine a number of sites and not just FgQf-16 was there are no known sites with a large number of Embarras Bipoints. So, in

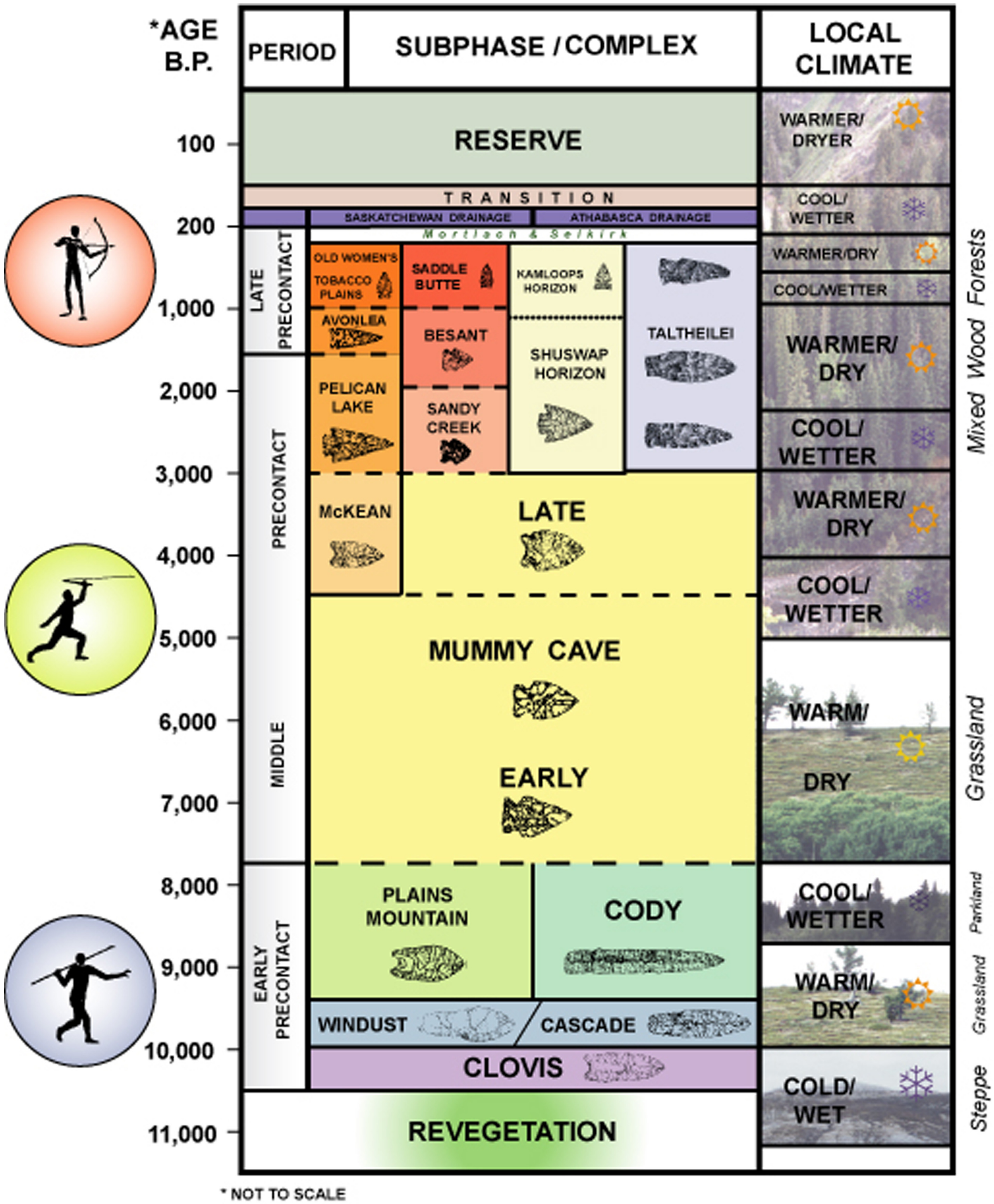

Figure 1.2: Culture History of the Eastern Slopes

order to create a sufficient data set of Embarras Bipoint there was no need to be restricted to only a few sites.

1.8. Concluding Remarks

This thesis is not an all-encompassing analysis of Early Middle Period culture or even its tool assemblages. Instead this is the analysis of one tool type, the Embarras Bipoint, and the lithic artisans that made them. According to Bonnichsen (1977:69), “the decision models use by stone tool craftsmen[sic] are not thought to be reflective of the cognitive maps of the whole society”. But, the elucidation of one tool type may shed light on other tools and, with a greater understanding of the tool assemblage and the artisans who made them, we may be able to glean a more holistic understanding of the societies and cultures of the Early Middle Period along the Eastern Slopes of Alberta.

Chapter 2
Overview of the Early Middle Period

2.1 Introduction

This chapter will be a brief overview of the Early Middle Period. There is no way to include a thorough overview of this period of time without reorganizing the entire thesis and then turning it into a dissertation. Instead, the focus will be discussions on aspects of the Early Middle Period that are either relevant to Embarras Bipoints or that are personally interesting about the Early Middle Period but still relevant to my study area. Included in this discussion will be a review of land use strategies, environmental changes, technological innovations, and some of the projectile point types that occurred during the Early Middle Period. The focus will be on archaeological sites that are relevant to the study area but will draw from other areas when necessary. The Early Middle Period has been defined as the time period between 7,500 to 4,500 B.P.

This temporal designation is tied to several significant environmental and technological changes discernable in the archaeological record. Environmentally, this period is characterized as a warmer and drier period and has been called the Altithermal, Mid-Holocene Climatic Optimum, and/or Hypsithermal period (Bender and Wright 1988; Bryson 1987; Hurt 1966; Oetelaar 2004; Reeves 1973; and Walker 1992). During this time or more precisely at 6730 +/- 40 ^{14}C years BP (Hallett et al. 1997) there was the Mount Mazama eruption which blanketed much of the Plains and some of the Parkland and Boreal Forest areas with a layer of tephra (Hickman and Schweger 1991:3; Doll 1982:65). The interesting aspect of this drying and warming trend was that the now forested area where many of the Embarras Bipoints have been found would have been a more open, possibly grassland, environment.

2.2. Dates for the Early Middle Period

Radiocarbon dates from archaeological sites within my study area are limited by the poor preservation of non-lithic materials because of forest soils which are acidic. The few relevant dates are presented in Table A.3 which also includes other Early Middle Period sites with either radiocarbon dates or diagnostic artifacts. To compensate for the lack of absolute dates, archaeologists have relied on cross dating, using projectile points and other diagnostic artifacts to establish the culture history for this area.

The few sites with radiocarbon dates include a site, an Early Mummy Cave occupation at Brule Lake that was radiocarbon dated to 7,010 +/- 1,860 years B.P. (Meyer and Roe 2006a:13). The Mountain Creek Site near Pocahontas in Jasper National Park has a radiocarbon date of 6,620+/-120 years B.P. (Meyer et al. 2002b:17). A slightly younger but potentially relevant date comes from the Track site, also near Pocahontas, which had a date of 3,450+/-400 years B.P. (Meyer et al. 2008a:15). Slightly further afield but still within my study area is a Mummy Cave Complex site in James Pass that has been radiocarbon dated to 7,575 +/-150 years B.P. (Meyer et al. 2002b:18). Lastly, the earliest dates in Alberta for the Early Middle Period in the Parkland and northern Prairie region come from, "the Boss Hill Site Locality 2 [....], with dates of 7,875 +/-130 years B.P. (S-1251) and 7,750+/-105 years B.P. (S-1371)" (Doll 1982:79).

With only a few absolute dates, a profound confidence has to be placed on diagnostic stone tools to establish the perimeters of the Early Middle Period. The following are key examples to establishing the Early Middle Period presence along the Eastern Slopes region. DgPl-85, a site with an Embarras Bipoint in level 1, has been dated to pre-5,500 B.C. (Reeves 1972:79-80, 181). At GbPv-1, a site within the Gennesse project area, "the middle component is affiliated with early post Altithermal" (Ronaghan and Hanna 1981:iv). Closer to the core of my study area, FhQg-2 has been relatively dated to, "the Middle Prehistoric Period ca. 5,000 B.C. - A.D. 100/300" (Calder and Reeves 1978:17). At FgQe-14 and 16, two sites with Embarras Bipoints the, "projectile point comparisons suggest that FgQe-14 and 16, are of Early Middle Prehistoric age (5,500-1,500 B.C.)" (Calder and Reeves 1977:29). A Mummy Cave projectile point was recovered at FcPu-2, another Foothills site, during the H.R.I.A of the Sundre Forest Products Forest Management Area (Somer 2006:56, 68,158). Near the hamlet of Robb, "diagnostic artifacts (projectile points and, to a lesser extent, associated artifacts) from FhQf-10 suggest a series of occupations extending back 4,000 to 5,000 years" (Hunt 1982:145-146).

FgQe-16, “is associated with the Mummy Cave Complex" (Calder and Reeves 1977:8). Lastly, at FgQf-16 a suite of Early Middle Period projectile points were recovered from the 2005-06 excavations (Meyer and Roe 2006b). The continuing work being done in this area vastly increases the chances that more radiocarbon and relative dates will be found to improve our understanding of the Early Middle Period presence along the Eastern Slopes.

2.3. Land-Use Strategies

One of the hallmark traits of the people of the Early Period is the immense distances they travelled to obtain goods and resources. A prime example comes from FfQh-26, near the hamlet of Cadomin, a multi-component site that has Early Period projectile points of Knife River Flint (KRF) including a number of Cody Complex points (Meyer et al. 2007). The straight-line distance between FfQh-26 and the KRF quarries in Dunn and Mercer Counties of western North Dakota would be well over 1,100 km. As pedestrian people that is a colossal interaction sphere for either trade or migration. At the dawn of the Middle Period these large interaction spheres splintered and became more regional. According to Kelly and Todd (1988) during the Early period peoples moved more frequently, used less food storage, and less faunal resources. This changed during the Early Middle period where people began mapping onto the land, relying more heavily on seasonally available local resources (Reeves and Dormaar 1972:334).

2.4. Toolstone Use

One of the strongest arguments for the shift from highly mobile groups to more regionally based groups comes from the shift in toolstone use. Less often would the people go great distances to obtain high quality toolstone to manufacture their tools. As an alternative, the people were seeking out and exploiting the better materials found locally. One of the major draws to the Eastern Slopes, especially centred on the town of Hinton, was the high quality metaquartzites which will be discussed in Chapter 4. This use of more locally derived toolstone has been noted by a number of archaeologists working in the area. For example Meyer, Roe and Dow (2008:14) note,

> There is more emphasis on the use of local toolstones in Mummy Cave in the Alberta Rockies. Late Mummy Cave sites in contrast tend to have more materials from Montana. This localized toolstone procurement pattern is characteristic of Mummy Cave complex sites

> in the Northwestern Plains/Rocky Mountain. This shift reflects a change in north-south trade/exchange for high quality toolstone because of a more localized Native band movement pattern partially because of the expansion of local habitat along the foothills and Eastern Slopes.

From their analysis of FhQg-2 materials Calder and Reeves (1978:15) note, "the FhQg-2 lithic material is almost exclusively (99.5%) derived from local quartzite cobbles… The remaining 0.5 % of the lithic materials (N=45) include a variety of cherts, likely pebble cherts, siliceous siltstones, ironstones and sandstones". At another site in this area they note that the, "extensive use of local materials and quantities of associated debitage are a characteristic feature of the Mummy Cave Complex which the FgQe-14 occupation is related to "(Caulder and Reeves 1977:6). Comparatively, Calder and Reeves (1977:27) find, "the lithic materials present in sites FgQe-14 and 16 are predominantly (95.4%) fine grained quartzites obtained from local quartzite cobbles". Hunt's (1982:151) work at FgQh-10 concluded that, "raw materials [that] include quartzite and other rock types are generally locally available, with quartzite being the most abundant". Lastly FgQf-62, a site with an Embarras Bipoint, has been interpreted as being a, "workshop where locally obtained quartzite cobbles were fashioned into finished, shaped stone tools" (Meyer et al. 2002b:84).

At sites further afield Doll (1982:98) noted that in the strong Early Middle Period component at the Boss Hill site that, "approximately 80 percent of the raw materials used in manufacturing finished tools was available in local glacial deposits". At GbPv-1 and 2 all of the lithics used to manufacture stone tools could be procured locally (Ronaghan and Hanna 1981:105). To the south in the Crownsest Pass, "campsites of the Mapleleaf Subphase [7,500 to 3,000 years B.P] contain large amounts of Etherington Chert" (Driver 1978:143, 1983). Etherington chert outcrops at several locations in the Crowsnest Pass, making the toolstone a local material. At the Stampede Site (DjOn-26), another site with a strong Early Middle Component, the lithic assemblage for this time period consisted predominantly of locally derived toolstone (Vivian et al. 2008). To illuminate the change in toolstone use, even further to the south in Wyoming during the Early Middle Period there was the, "shift from the presence of projectile points manufactured out of non-local raw materials in Paleoindian chipped stone assemblages to the appearance of Archaic points manufactured from primarily local materials"

(Larson 1990:57). These examples provide a generalized trend in toolstone use during the Early Middle Period in and along the Eastern Slopes and through the adjacent plains.

2.5. Diversity in Diet

Another notable change during the Early Middle Period was the shift towards a more diverse diet. This change may be related to the archaeological preservation of floral and faunal remains not present during earlier times. Nevertheless, the term, "faunal diversity" has been used by Driver (1978:152) to characterize the diet of Early Middle Period peoples in comparison to earlier peoples. Included in their diet would be animals such as Bighorn Sheep, Mule Deer (Hughes 2003; Kornfeld et al. 2001:319; Frison et al. 1976:53), wolf, and antelope (Frison et al. 1976:53). At DjPp-8, in the Crowsnest Pass, the faunal assemblage consisted of elk, beaver, sheep, hare, muskrat, bear, canid, Lynx, and fish (Reeves 1974:69; Driver 1978:210). Yet, as with the people before and after, the Early Middle Period was dominated by the use of bison (Frison et al. 1976; Kornfeld et al. 2001:319; Reeves and Dormaar 1972:332). The increase in faunal diversity was in tandem with an increase in floral diversity (Frison 1991; Kelly and Todd 1988), which provided a well-rounded diet for the peoples of the Early Middle Period.

2.6. Blood Residue

Because of the poor preservation of faunal remains in many places along the Eastern Slopes of Alberta other avenues need to be explored to determine the diet of the peoples during the Early Middle Period. One way is through the use of blood residue analysis. The following examples are given to illustrate the diversity of animals that were exploited. At, "FfQh-24-168, the quartzite Early Middle Period point, produced a positive result to bovine antiserum (referred to as FfQh-24-2a in Appendix B). This most likely indicates that the tool was used in the hunting or preparation of bison" (Meyer et al. 2007:57). The Embarras Bipoint from FgQf-62 tested positive for *Rangifer tarandus* (Caribou) indicating an, "open forest environment with more tundra plant communities supporting lichens and other plants suitable for caribou" (Meyer et al. 2002b:83). Another Embarras Bipoint from FiQe-20 tested positive for sheep which would most likely be Big Horn Sheep or *Ovis Canadensis* (Meyer et al 2008b) One of the tools from FgQf-16, a wedge possibly used for processing bone, tested positive for bear, either Black

(*Ursus americanus)* or Grizzly (*Ursus arctos)* (Meyer and Roe n.d.). For more examples of tools testing positive for blood residue see Tables A.1 and Table A.3.

2.7. Environmental Conditions of the Early Middle Period

Any discussion of the Early Middle Period would be remiss without looking at the environmental changes that were happening on a local, regional, and even continental scale. Numerous researchers have shown that during the Early Middle Period there were trends of drier and hotter periods that had an effect on settlement and subsistence patterns. For example, at Mummy Cave in Wyoming the sediment deposition was studied to determine environmental conditions, the idea being there would be a greater deposition of sediment during wetter periods and less during drier periods. It was shown that there was, "minimal deposition occurring between 7,190 and 5,850 BP." (Hughes 2003:20). Further to the north in the Rocky Mountains of Southern Alberta, at the Gap Site, Reeves and Dormaar (1972:334) have shown that, "the sequence of buried soils indicates a shift in vegetation cover from a probably subalpine association at ca. 6,000 B.C. to a grassland association by 4,700 B.C. The latter maintained itself until ca. 4,000 B.C. and was followed at some subsequent time by a shift to the forest cover extant on the site today". Also a span of, "the Altithermal climatic period from approximately 7,000 to 6,000 B.P. increased the grassland area of Crowsnest Pass, while reducing the forested regions" (Driver 1978:171). More central to this thesis, Hickman and Schweger's (1991:3, 10) paleoenvironmental work at Fairfax Lake shows the environment to be warmer and drier prior to the Mid-Holocene Optimum after which it became wetter and cooler, but they also mention that this could be a results of larger amounts of winter snow affecting average water levels. Thus, the dates they obtained could be erroneous, of which they agree, and need to be regarded cautiously. At GbPv-1 and 2, "the possible existence of grasslands in the Athabasca Valley during this time may have meant the Carson Lake area was an ecotone between these grasslands and the forested Swan Hills uplands" (Ronaghan and Hanna 1981:79-80). In reference to the Embarras Plateau, Meyer et al. (2008a, 2008b) discuss how the drier and warmer conditions during the Early Middle Period would have prolonged the warmer seasons in the alpine areas ultimately reducing the snowpacks creating more favourable environments for grazers. Also, according to Calder and Reeves (1977:32), "FgQe-14 and 16 are part of a local expression of the Mummy Cave Cultural complex which occupied the southern Alberta Rockies between ca 5,500-1,500 B.C.

Many of the sites of this complex predate 3,000 B.C. and were occupied during the Atlantic Climatic Episode, the time of optimal environmental conditions in the Northern Rockies for Prehistoric man [*sic*]". Lastly, along McPherson Creek, which is in my study area, McCullough noted, "during the Altithermal (ca. 5,500-1,500 B.C.) a period of high temperature, particularly the post-glacial thermal optimum when the study area may have been more open as the result of invading grassland communities" (McCullough 1982:18).

Regardless of the environmental conditions, the scarcity of archaeological sites, and the debatable hiatus on the Plains during this time period, there is very strong evidence for a continued use of the foothills and mountains (Bender and Wright 1988; Meltzer 1999; Reeves 1973; Reeves and Dormaar 1972; Sheehan 1994, 1995; Vivian 1999). This continued use of the Foothills and Mountains can definitely be seen from the work being done by Meyer and Roe (2008a, 2006a, 2006b). This trend is not exclusive to the Foothills of Alberta but extends south to Wyoming where a significant number of Early Middle Period sites have been found (Frison 1976, 1975; Hughes 2003; Wedel et al. 1968)

Bender and Wright (1988:626) proposed a broad spectrum model approach where, "the mountains in general become yet another stop on the round of annual movements made by small-scale hunting and gathering bands". In any case, any suggestion of movement into the foothills and mountains because of the Altithermal or environmental stress should be made very cautiously. Resource availability, environmental conditions, and human adaptive responses to foothill and montane conditions need to be considered (Bender and Wright 1988:620). In other words, the Eastern Slopes should not be seen as a refugium or conversely as a marginalized ecotone to be used only during times of stress but as a vibrant and sustainable environment equal to other major environmental or geographical zones.

2.8. Technological Changes in the Early Middle Period: Stone Tools

There are numerous technological changes that occurred during this time period. An entire thesis could be devoted to the establishment, physics, uses, and overall impact of the atlatl as a projectile system or the technological mastery and conservatism of split pebble technology. This section will be a brief introduction to some of the other stone tool types developed during the Early Middle Period along the Eastern Slopes and out into the Boreal and Plains Region. They will be discussed again in slightly more detail in Chapter five.

Five other stone tool types, that are not projectile points, but which are characteristic of this time period include Lovett Unifaces, Reverse Unifaces, Erith Knives, a yet unnamed hafted knives, and unusually large bifaces (Figure 2.2). Each of these stone tool types has unique qualities that need to be explored in a similar fashion to this thesis on Embarras Bipoints. At least two studies have been done or will be done with Reverse Unifaces (Kastan 2004, and Matthew Stuart personal communication, 2009), and hopefully more work will be done with the other tool types.

Two reoccurring themes connect all of these stone tools. The first is the almost universal use of quartzite and the other is their analogous reduction sequence(s). All of the known examples of these tools, Figure 2.2, have been made from quartzite. Further research on these tools may prove differently but with confidence one could state that they are all made from locally derived toolstone. The second theme is that the actions and techniques used in the manufacturing process of these tools were drawn from a collective pool of technological knowledge. For example, Lovett Unifaces and Reverse Unifaces are mostly identical except for the main focus of reduction, which ultimately results in distinct but similar tools. In other words, Reverse Unifaces have most if not all of the flaking taken off the ventral surface where Lovett Unifaces have most of the flaking taken off the dorsal surface. A chaîne opératoire analysis, or any type of analysis, would be an important step towards establishing a better understanding of these tools and the roles they played in the Early Middle Period.

2.9. The Introduction of the Atlatl

When was the atlatl or spear thrower invented? Where did this occur? When was the atlatl introduced into the New World? Was this introduction by diffusion or was the atlatl a separate innovation in the New World? How long after the introduction of the bow and arrow was the atlatl used? These are some very interesting questions and worthy of exploration and discussion but well beyond the scope of this project. In order to simplify matters, the atlatl was evidently well established and used, probably exclusively, in the 7,500 to 4,500 year range along the Eastern Slopes. The act of notching projectile points has been presented as indirect evidence for atlatl use because notching facilitates a more secure haft on to the dart or fore shaft. This is because the power, energy transfer, and release in an atlatl projectile system are much greater than with a hand thrown spear projectile system and the stone tip needed a more secure hafted to

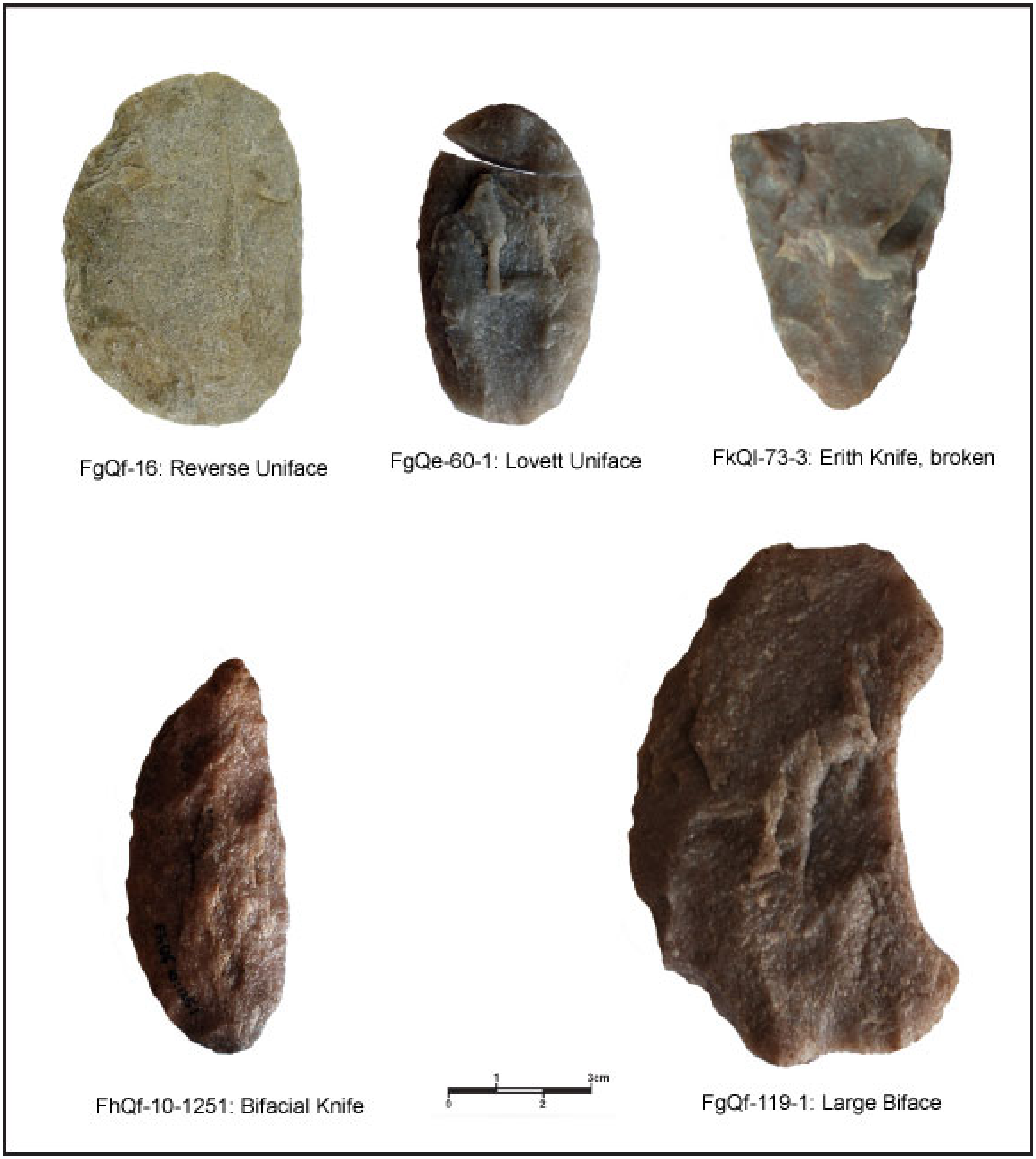

Figure 2.2: Other Diagnostic Stone Tools of the Early Middle Period

be effective. For a more in depth discussion on this and other interesting aspects of the atlatl one is directed to the works of Butler (1975), Howard (1975), Hutchings and Brüchert (1995, 1997), Peets (1960), Shott (1997), and Thomas (1978). In any case, all of the stone tips that are datable to the Early Middle Period along the Eastern Slopes have evidence of notching and were most likely part of an atlatl projectile system.

2.10. Split Pebble Technology

Split pebble technology was not exclusive to the Early Middle Period but there does appear to be a high proportion of split pebble or bipolar reduced stone tools associated with this period of time (Ernest Walker 2006, personal communication). Bipolar percussion or split pebble technology has been described as follow:

> ...to hold with one hand the objective piece of material to be manipulated (such as a pebble core) on a hard, flattish stationary anvil-stone so that the distal end is in contact with the anvil… Then it is struck on the proximal end with a hammerstone that is held in the other hand. When the percussion is applied at the proximal end of the specimen a force rebounds from the anvil, and a primary force at the point of impact also occurs. The applied pressure, therefore, produces force from both the anvil and the percussor. When applied force is in direct opposition to the rebound force the material will exceed its elastic limit and the objective piece of material will shatter or shear (Low 1997:12-13).

One common argument for the use of bipolar percussion was for the conservation of high quality toolstone in areas with limited amounts or access to good toolstone. Another argument, which will be explored in this thesis, is that bipolar percussion was the most successful method for initiating the reduction sequence of larger cobbles of tougher toolstone such as quartzite. For further discussion on split pebble technology one is directed to the work of Bartham (1987), Low (1997), and Steuber (2008).

There are numerous tool types that can be initiated, facilitated by, or made using bipolar reduction. Some are similar in form but different in function, such as pièces esquillées and wedges, while others are unique like microblade cores and scraper preforms. Many of the quartzite cobbles that were the starting points for Embarras Bipoints were most likely split using bipolar percussion.

2.11. Projectile Point Types of the Early Middle Period

Discussing the projectile point types of the Early Middle Period is like opening Pandora's Box. There are many different types and every archaeologist has an opinion on those types. This section will be a brief discussion of the stone tips found in association with Embarras Bipoints as well as other archaeological sites dated to the Early Middle Period within my study area. A few comments will be made on the possibility of a new stone tip type that would be component of a regional sub-phase of the Mummy Cave Complex based on the preliminary works of Meyer and Roe (2008a, n.d.). Although important, projectile points are not the only diagnostic tool to be used; this is why this section may be found lacking by some archaeologists.

One way to understand something new is to relate it to what you already know. This may be why the projectile point types of the Boreal Forest and the Eastern Slopes are extensions of those for the Plains. One justifiable argument for the Plains influence on Eastern Slopes point types is, "Brink (….) sees these influences occurring particularly during the Middle Prehistoric Period (ca. 5,500 B.C. – A.D. 200-700) and suggests that they may have occurred as a result of a climatic differences occurring during the Altithermal (ca. 5,500-1,500 B.C.) (a period of high temperature, particularly the post-glacial thermal optimum) when the study area [the McPherson Creek Area] may have been more open as the result of invading grassland communities" (McCullough 1982:18). However, this assumes a similar environment was the only criteria for the homogeneity of peoples across a landscape. One could argue that even though there does appear to be similarities between Large Side-Notched points between Wyoming and Alberta there are too many other differences to assume the same cultural group made them.

An alternative approach to understanding the diagnostic role of projectile points would be to see them not only as temporal but regional markers. An encompassing complex, such as Mummy Cave, can be used to umbrella the temporal range of Early Middle Period projectile points. But, each point assemblage should be assessed based upon its regional value rather than by its provincial, state, or national value (the modern geographic boundaries are used here just to illustrate scale). When the focus is on understanding the regional significance of a projectile point then the strains of trying to fit it into a larger macroscale culture history are removed. For example, a point made from Knife River Flint most likely carried less economic value in Dunn County than in Yellowhead County. Conversely, the use of local materials becomes more important when the material being chosen has some economic, social, and/or cultural value that does not translate to other areas. Again, a point made from quartzite found along the Lovett River has regional significance that is not relevant to a quartzite point found along the Missouri River. What characteristics of that quartzite piece made it valuable enough to be made into a projectile point? These types of questions cannot be answered unless projectile points are considered for their regional significance.

To best illustrate this point I will draw from the ongoing work being done at FgQf-16. Most of the stone tips, (Figure 2.3), recovered during the excavations can be categorized as Early Middle Period projectile points. According to Walker these projectile points have all of the characteristics of Gowen points from Saskatchewan (Walker 2006, personal communication). This confirmation with a known point type is important because it provides a temporal context for the points. However, using a Prairie dominated typology does not reflect the importance these tools have to the region they were recovered from. Granted, knowing these points are Mummy Cave Complex points does place them within a greater temporal and cultural framework, indicating that like peoples could occupy different geographical areas. However, this begs the question of why people were making Large Side-Notched points in this region? What separates or makes them distinct from peoples making similar points in other areas or regions? What overall similarities do these people have with those same groups?

One solution is to create regionally based sub-phase(s) and/or type(s) within the greater Mummy Cave Complex. Included in these sub-phases would be the other tool types, and features associated with the projectile points that make them distinct. For the Mummy Cave Complex component of FgQf-16 and other sites such as FfQh-26, FfQh-27, FhQf-10, and FgQe-16 with similar assemblages, the preliminary Embarras Sub-Phase (7,000-4,000 years B.P.) has been proposed (Meyer and Roe 2008a). Within this Sub-Phase would be Embarras Side-Notched points the local expression of the Mummy Cave Complex projectile point, Embarras Bipoints, and unidirectional split cobble/pebble cores. Other characteristics would include the reliance on bison and other large ungulates and the use of local high quality toolstones including quartzites and Nordegg Member Silicified Siltstone. The use of stone boiling and related technologies are uncommon, as well as smaller formal tools such as thumbnail scrapers. Most of the sites associated with this Phase have a core area focused in and along the Foothills area, more specifically, in more open environments, such as the Embarras Plateau and the Hightower Creek area.

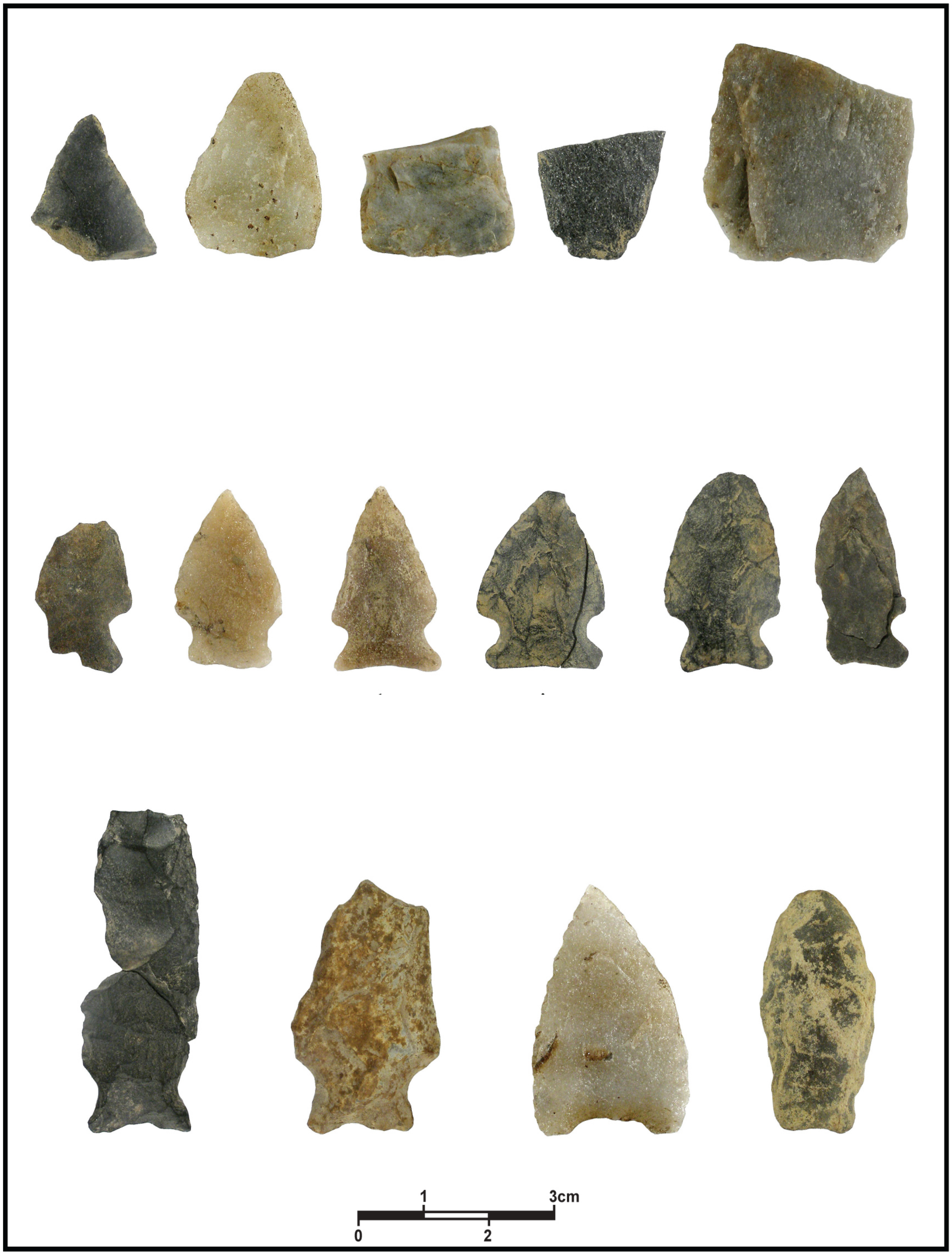

Figure 2.3: Projectile Points from FgQf-16

2.12. Concluding Remarks

The intent of this chapter has been to provide a brief discussion of the Early Middle Period focusing on topics such as temporal, environmental and geographical characteristics, land-use and resource procurement strategies, technological changes, and other tool types of the Early Middle Period along the Eastern Slopes. Many of the ideas presented here, especially on the Embarras Sub-Phase, are at a preliminary stage and may evolve or change completely with future research.

Chapter 3

Theory: Chaîne Opératoire

3.1. Introduction

The chaîne opératoire or operational sequence approach and stone tool replication are a perfect match. The reduction sequence in the manufacturing process of a stone tool parallels the series of actions in a chaîne opératoire. In this chapter I will provide a definition of chaîne opératoire as it is has been explicated in the literature, outline the process and parameters of creating an operational sequence, and examine some of the positive and negative aspects of chaîne opératoire. Another objective of this chapter is to establish a bibliographic data set for future work with both operational sequencing and stone tools from the Early Middle Period. This review of the chaîne opératoire approach, and experimental replication, will be an attempt to show that the anthropology of techniques or chaîne operatoire is the most useful theoretical approach to studying Embarras Bipoints.

There are a number of very interesting features of Embarras Bipoints (see also Roe 2005a and 2005b) which I believe can be understood through chaîne opératoire analysis. These morphological features are addressed in Chapter four, but as a preamble, these stone tools where fashioned following a regimented reduction sequence. Studying these sequences of operations or actions will reveal that Embarras Bipoints are more than just random bifacial stone tools. The use of the chaîne opératoire approach works for the study of Embarras Bipoints because, "the study of relations between material culture and society then becomes the study of conditions of coexistence and of reciprocal transformations of a technical system and of the socioeconomic organization of the society in which it operates" (Lemonnier 1986:154). So, by looking at the chaîne opératoire one has the opportunity to address Embarras Bipoint production on a, microscale (Dobres and Hoffman 1994:213), or micro-behaviour (Banffy 2005:1) where each action is analyzed independently, as well as interdependently of the other actions. This will not only shed light on the technological factors such as reduction, use, and discard but also more macroscale interpretations of the lifeways of the people who made and used Embarras Bipoints. Ultimately, studying the anthropology of techniques or chaîne opératoire of Embarras Bipoint will allow for a more meaningful understanding of the social, cultural, and individual aspects which influenced their techniques of manufacture.

3.2. A Brief History of Anthropology of Techniques

The anthropology of techniques is a very popular analytical approach to studying cultural material. The concept first came into fashion by way of the *Techniques et Culture* school of thought developed by Andrea Leroi-Gourhan and Marcel Mauss in France in the 1950's (Audouze 2002; Chazan 2005; Jennings et al. 2005:277). Since then many scholars have taken the basic premises established by Leroi-Gourhan and Mauss and created what has been dubbed in English the Anthropology of Techniques. A brief list of people who have used the chaîne opératoire approach includes Audouze (2002), Bar-Yosef et al. (1992), Bednarik (2005), Bleed (1991, 2001, 2002a, 2002b), Bonnichsen (1977), Bouissac (2005), Chazan (1997, 2005), Child (1991), Close (2004), David (1992, 1999, 2003), David and Kramer (2001), Dibble (1995), Dietler and Herbich (1989), Dobres (1992, 1995, 1995a, 1996), Dobres and Hoffman (1994), Ellis (2004), Eren et al. (2005), Flenniken (1978), Gamble (1998), Gheorghiu (2005) Gosselain (1999, 2000), Gosselain and Livingstone Smith (2005), Hassan (1976, 1988), Hayden (1977), Hill (1978), Hiscock and Attenbrow (2003), Hosler (1996), Jennings et al. (2005), Karimali (2002), Kastan (2004), Killick (2004), Leach (1984), Lemonnier (1986, 1992, 1993, 2006), Matthews (2004, 2005), Meyer (1999), Pfaffenberger (1992), Sinclair (1995), Stanfill (1988), Stout (2002), Torrence (1989), Tostevin (n.d.), Van der Leeuw (1994), Vianello (2005), Waldorf (1993), Whittaker (1994), Wurz (2002), Wynn (1985). Each of these authors, as well as numerous others, have taken the principle tenets of the chaîne opératoire approach and are using it in the analysis of a variety of material culture studies.

One refreshing aspect of the anthropology of techniques is the theoretical move away from the diffusionist approach of the cultural historians (Trigger 1989), for example and, "the application of natural selection theory to the study of adaptation and biological design in an ecological setting" (Broughton and O'Connell 1999:153), of evolutionary ecology. With the operational sequencing approach, the focus is directed towards the social agency behind the cultural material rather than just the culture material or ecological determinism. Another way to appreciate this point is that the anthropology of techniques is more focused on the flintknapper than the stone tool, or more specifically the techniques used by the knapper and what those techniques mean.

3.3. Defining Chaîne Opératoire

From the literature there is a wide range of terms for defining specific variables and applications of chaîne opératoire. Many of these ideas and terms as possible will be explained to provide a general foundation for the chaîne opératoire concept. There are a number of good definitions for operational sequencing. The best definition comes from R. Cresswell's quote in Lemonnier's (1992:26) article *From Field to Files* which defines chaîne opératoire as, "a series of operations which brings a raw material from a natural state to a manufactured state". Another would be Schiffer and Skibo's (1997:29) definition which is, "the entire sequence of activities in an artifact's life history". David (1999:17) in an article on iron smelting in Cameroon defines chaîne opératoire as that which, "demarcate[s] what is determined by raw materials and physico-chemical constraints versus the areas of potential cultural choice". The most general and therefore most inclusive definition of chaîne opératoire comes from Lemonnier (1992:26) who states, "an operational sequence is more simply the series of operations involved in any transformation of matter (including our own body) by human beings". All of these definitions are excellent and encapsulate the basic character of the operational sequencing approach.

The transformation of a raw material to a finished state, the basic premise of a chaîne opératoire, has been referred to by different people using various terms. Obviously, French archaeologists use the term chaîne opératoire (i.e. Lemonnier 1986, 1992) while Anglophone archaeologists use operational sequence (i.e. Bleed 2001). Archaeologists with a more behaviouralist slant refer to this concept as a behavior chain (Schiffer and Skibo 1997). Japanese archaeologists refer to the sequence of operations as, "Gihō" (Bleed 2001:104), Bleed (2001:101) in the same article refers to this process as a "sequence model". Bordes (1968), Crabtree (1966, 1967a, 1967b, and 1982), Flenniken (1978), Gryba (1988), Hellweg (1984), Kooyman (2000), Leach (1984), Patten (1999), Sollberger (1985), Tostevin (n.d.), Waldorf (1993), Whittaker (1994), and others dealing with Precontact lithic technology from the New World refer to this process as a reduction sequence or sequencing. Although referred to by a number of different terms, the concept of chaîne opératoire refers to the process and actions involved in the transformation of a raw material to a finished state.

Before continuing I would like to briefly explore one approach to chaîne opératoire in more depth. Hassan has employed a hermeneutic approach to analyzing Egyptian blades and in his 1988 paper, *Prolegomena to a Grammatical Theory of Lithic Artifacts*, where he created a generative grammar theory. Hassan believes material culture, and in this case flint Egyptian blades, are an, "exemplification of structured cognitive processes" (Hassan 1988:281), and as such may be regarded as, "information" (Hassan 1988:283). The idea of material culture being information can be broken down into formal elements which are guided by syntactic and semantic rules or, "rules by which all information needed for conceptual design, [sic] manufactural, and functional elements of an artifact are included" (Hassan 1988:284). To take Hassan's approach in a slightly different direction would be to see material culture as words and sentences. To do this one has to see a word being equal to a, "formal element" (Hassan 1988:284) or an action. In terms of a lithic reduction sequence, this word would represent a flake and the actions involved in producing this flake.

Furthermore, David and Kramer (2001) in their book *Ethnoarchaeology in Action* touch on this idea when discussing some of Ian Hodder's ideas on style and identity. They state that Hodder, who referring to Leach's 1976 paper, says, "that patterning in all the non-verbal dimensions of culture incorporates 'coded information in a manner analogous to the sounds and words of a natural language,' and that it is therefore meaningful to talk about 'grammatical rules which govern the wearing of clothes' or other domains of material culture" (David and Kramer 2001:193). There are numerous ways to apply chaîne opératoire to the study of material culture.

3.4. The Links in the Chain, or Actions

For an object to be made, a series of events that are interlinked must be performed to take that object from a raw state through to a finished state. These events or link in a chain of operations has been called different things by different authors. Hassan (1988:284) refers to these links as formal elements. Lemonnier and others define a link as a technical action or process (Lemonnier 1986:149, 1992:30; David 1999:16; Banffy 2005:1; Jennings et al. 2005:277; and Leach 1984:9). Bleed (2001:102) refers to links as operations. Schiffer and Skibo (1997:29) define a link as an interaction. A number of other authors have defined a link as a, "technological act" (Dobres and Hoffman 1994:212; Dobres 1995:29; Bleed 1991:19; and Chazan 1997:721). Other authors refer to an action as a gesture (Banffy 2005:1; Bednarik 2005:1; Bouissac 2005:1; Chazan 2005:1; Lemonnier 2005:1; Matthews 2004:1; 2005:1; Vianello 2005:1). The term for link or action according to Sheets (1975:372) is a manufacturing behaviour. In their analysis of Sub-Saharan clay procurement practices, Gosselain and Livingstone Smith (2005: 3) referred to links as technical practices. Clearly, there is no shortage of terms for the concept of a link, so for the sake of simplicity I will use the term 'action'. The reason is twofold: First, an action involves some sort of event which invariably leads to a reaction. For example, the down swing of a hard hammer percussor on to a core (action) will under the right circumstances produce a flake (reaction). The second and more important reason is that an action can be imbued with social, cultural, and individual agency which will influence and dictate that action. In the production of an object, each action will not only be dictated by a collective pool of basic motor skills (Sackett 1982:67), but also by more cognitive learned behaviours. Dobres (1995:257) astutely sums up this idea when she states, "technical acts [actions] are irreducibly social acts [actions]". This means that when a person decides to produce a flake they will, in order to produce said flake, draw from both a cerebral and somatic collective pool of learned behaviour.

3.5. The Four Elements of an Action

According to Lemonnier (1986:152) there are, "four elements which define any technical process [i.e. action]—material, tool, action, and specific knowledge". Lemonnier's four elements of an action are exceptionally similar to Bonnichsen's (1977:64) four levels of behaviour attribute organization which include, "a priori knowledge of material behavior…decisions made in combining input variables…. The internal structural relationship of constructional units.… [and] the decisions required to achieve external relations or the outline form of artifacts, i.e., the final form". Identifying the elements of an action and how they relate is the necessary to understand the action and how it relates to other actions within the chaîne opératoire.

3.5.1. Raw Material

Understanding the dynamics or fundamental mechanics of the raw material(s) is integral to understanding an action in a chaîne opératoire. There are three general, but very different, schemes to manipulating raw material in order to produce a finished product. The three schemes are open, closed and restricted. Each scheme will be directed or influenced by the medium and thus so will the technology used to produce a finished product. A scheme can be understood as the technological opportunity for error correction in the process of making an object. In other words, the greater the ease or chance of fixing an error, the more open the scheme or, conversely, the less likely an error can be corrected the more closed the technological scheme.

The first scheme is open. This means the medium being used may have restrictive qualities, but overall is far more emendable to error correction than other mediums. The best example of an open scheme is ceramics. Although there are certain restrictions involved, such as in the firing process(es), overall the shaping process can be manipulated by an individual in an almost infinite number of ways. Conjunctively, an open scheme is usually an additive technology. The process of building a pot requires the paste be combined, using any number of methods, to produce a pot. This is opposite to stone tool production, a reductive technology, where material has to be removed to produce an object. The best description of an open scheme as it relates to pottery comes from Gosselain (2000:190) who states:

> Most technical options related to different stages of the manufacturing process are functionally equivalent; that is, they allow potters to achieve similar goals. That means, first, little interdependence exists between the different stages of the process; a choice made at one level does not automatically condition the choices made at other levels. Second, both the manufacturing processes and uses of clay artifacts permit substantial flexibility in the selection and processing of raw materials. Consequently, changes may be made at almost any stage of the chaine opératoire without jeopardizing the whole system.

On the opposite end of the spectrum would be a closed scheme. A closed scheme involves any medium where there are only a set number of physical actions or techniques, which have to be produced in a specific order, to make an object. In other words, there is only one or a very specific sequence of events, not culturally influenced, bound by the fundamental mechanics of the medium. The good example of a closed scheme, although not related to archaeology, would be the filleting of a blowfish. If the fish is not cut in a proper manner then the result is either a ruined cut of fish or more importantly the illness or death of the person who eats the toxic results. This should not be confused with any of the cultural restrictions which may be involved with the production of an object - only the physical, mechanical, and chemical restraints of the medium.

To produce a stone tool or, more specifically a flake, there are certain physical and mechanical criteria which need to be met. Given the Hertzian cone principle any cryptocrystalline, isotropic, homogeneous toolstone can be fractured in any direction, but this still requires the right angle, energy, and percussor type. The fundamental mechanics of the medium will allow for any number of possible outcomes but only when certain criteria are met; therefore, all lithic technology should be considered restricted This does not mean working with knappable stone is more analogous to a closed scheme than an open scheme. Rather, one should see a restricted scheme as being tethered to the basic Hertzian cone principle which can be manipulated in any number of different ways to produce a finished object. So, to better understand an action in the chaîne opératoire of Embarras Bipoints, a restricted technological scheme has to be taken into account given the raw material.

3.5.2. Tools

To be fully cognizant of the analytical potential of an action one has to be aware of, and recognize, the full suite of tools which could be used to produce an object. In the case of stone tool production there are a limited range of tools suitable for making stone tools. Yet, Gosselain (2000:191) who is looking at ceramic practices in Sub-Saharan Africa states, “if potters can continue to use decorative motifs and tools that they were shown when learning to make pottery, they also may change them later, in response to informal contacts with other individuals, new fashions, economic concerns, a disposition towards innovation, or other influences”. This means, to fully appreciate the particulars of an action one needs to be aware of all the possible tools that would have been used and address the implication of these choices.

3.5.3. Action

The action here is the physical manifestation of where something is done with the intention of producing a result. The demarcation of an action, from other actions, is dependent on both the artisan producing an object and the analyst studying the object. For the analyst the dilemma can be choosing the same or similar parameters as the artisan. However, understanding the other elements of an action should provide some insights to what those parameters may have been.

3.5.4. Specific Knowledge

This is the most difficult to interpret and subjective aspect of an action. According to Lemonnier (1989:154), specific knowledge is, "know-how, manual skills, procedures, but also, […], a set of cultural representations of 'reality'". This is the component of an action where Hassan (1988:287) would include the idea of a flexible mental conception, which is a more fluid version of and not to be confused with a mental template. A mental template is defined as, "the idea of the proper form of an object [which] exists in the mind of the maker" (White et al. 1977:380). The flexible mental conception is the range in form which an object may take when completed and still be identified as a specific type of object. The specific knowledge of an action is the amalgamation of the flexible mental conception, understanding, in this case, a restricted medium, and knowing which physical action or actions are needed to produce a finished object. However, understanding of the flexible mental conception within specific knowledge is further complicated by the reality that, "although certain acts of appropriation are related to deliberate expressions of identity, others are so embedded in our cultural values and representations as to remain unnoticed, a part of our habitus" (Gosselain 2000:189). This means the study of specific knowledge, which is such a large part of the anthropology of techniques, will not be an easy task. For better understanding Embarras Bipoints the greatest accomplishment will be if we can at the very least make inferences about specific knowledge.

3.6. The Chaîne Opératoire as a Whole

Having discussed the four elements of an action, we move on to how the chaîne opératoire works as a whole. I will outline the chaîne opératoire process as an object is transformed from a raw state to a finished product. To facilitate this discussion a hypothetical chaîne opératoire has been provided and the following discussion will be in direct reference to this chaîne opératoire as seen in Figure 3.1.

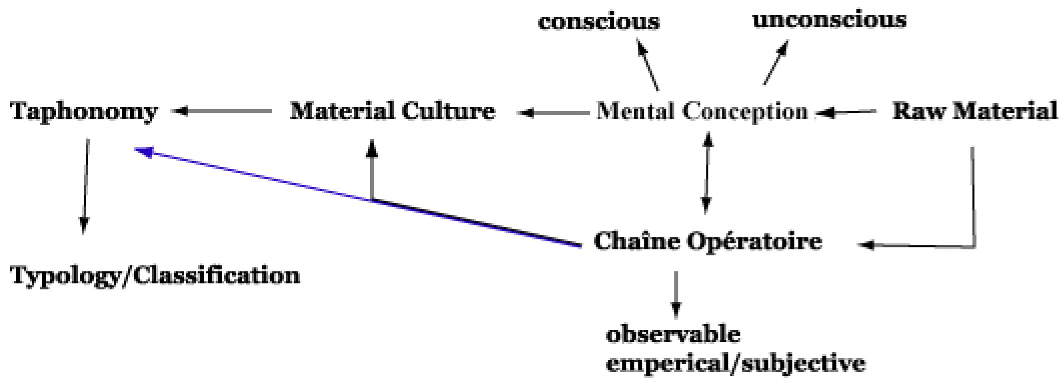

Figure 3.1: A Hypothetical Chaîne Opératoire

3.6.1. Raw Material

The first step to producing an object is the acquisition of raw material. This stage would be the very beginning of an operational sequence. It should be noted that the raw material stage of this formula does not include the cognitive, social, or political variables of raw material acquisition prior to the arrival at a quarry; say for example, the decision to quarry, travel considerations, or intended purpose. Especially in the case of Embarras Bipoints, these types of agency are outside the realm of understanding for any operational sequence unless there are physical manifestations which could then be tied into the chaîne opératoire. Another way to say this would be, raw material or toolstone cannot be considered part of a chaîne opératoire until the material has been physically, chemically, or otherwise modified in some fashion by an individual. In which case the stone would be altered from its original state and therefore would be part of the chaîne opératoire.

3.6.2. The Chaîne Opératoire

For the sake of simplicity, a generalized label 'chaîne opératoire' is used for this entire portion of the formula. Depending on the goal(s) of the analyst, this stage of the formula can be scaled to either a micro or macro level. The chaîne opératoire can be the entire operational sequence of transforming a particular object from a raw state all the way to a discarded state including the tools used, intended purpose and so forth. Conversely, at the micro-level, the chaîne opératoire can refer to a segment of a chain, for example the thinning of an Embarras Bipoint. And lastly, the chaîne opératoire label can refer to the investigation of a single action; for example, the bipolar splitting of a cobble. Because of the potential range of scale(s) the formula requires fluidity and the generalized label, chaîne opératoire, works for this purpose.

The most important and most obvious aspect of studying the operational sequence in its entirety, as a segment, or as just one link, is that all of the elements have to be physical manifestations. The actions have to be observable with either quantitative or qualitative features. This means the more inference the less validity, so one is cautioned to stay with the physical manifestations of an action as opposed to ones that are implied. But for the present study, each element of an action or actions will be treated as significant, be it empirical or subjective, as long as the features are observable physical manifestations.

3.6.3. The Mental Conception

As stated earlier in the paper, a mental template can be defined as, "conscious ideas and ideals of the artifact makers, so that their identification is equivalent to recognition of cognitive or emic types which are those that would be distinguished by the artisan" (White et al. 1977:380 quoting Spaulding, Rouse, and Thomas). Another, more appropriate, idea of the mental template is as a flexible, mental conception (Hassan 1988:287). Where the mental template is fairly rigid, the other is more flexible or a more fluid concept of a prototype or design. The mental conception stage of the formula has been sub-divided into either conscious or unconscious elements because there maybe elements of an action that are purposeful but others that are directed by habitus or some other learned behaviour. The flexible mental conception is basic to the chaîne opératoire because it is accepted that the maker has a cognitive prototype of the finished product that has the flexibility for alteration and change throughout the manufacturing process.

3.6.4. Material Culture

The label 'material culture' is an all-encompassing term for the use-life of an object. This is directly linked to the chaîne opératoire, as the process of making an object is wholly influenced by its intended purpose. In other words, the object would not have been manufactured unless there was a purpose; thus, the operational chain of the manufacturing process is directly tied to the later use-life of the object. As a matter of fact, the use-life of the object can be considered the terminal links in the chaîne opératoire. The chaîne opératoire, may for some, cease at the point where the object is discarded, lost, or otherwise entered into the archaeological record. In the next section I will argue that this is not, in fact, the end of the chaîne opératoire and, as such, continues until collected by the archaeologist.

As seen in Figure 3.1 the chaîne opératoire stage is directly linked to the taphonomy stage (the direct, blue, line connecting chaîne opératoire and morphology). This is representative of the manufacturing residue from the production of an object that is deposited directly into the archaeological record. In the case of stone tool production, this connection would be debitage. However, if the debitage is used for some purpose then it goes directly to the material culture stage.

3.6.5. Taphonomy

As mentioned earlier some may consider the chaîne opératoire of an object complete when the object is transplanted into the archaeological record. Taphonomy is included because even though the culturally intended purpose of an object has ended, there may be natural transforms that obliterate, smear, or otherwise affect the object. In other words, even though these natural transforms may not be cultural, they are part of the object's life history. The study of the various transformation processes affecting Embarras Bipoints between the time of their discard and being found by archaeologists would be a fascinating study but will have to be left for future consideration.

3.6.6. Typology/Classification

The last category in Figure 3.1 is what archaeologists do with the material culture once recovered from the archaeological record. Our biases and influences will affect our interpretation of the object and therefore the chaîne opératoire. A prime example showing archaeological biases would be the style versus function debate (for examples see Sackett 1977, 1982, 1984, 1985, 1986, 1990; Wiessner 1983, 1984, 1985, 1989; and Wobst 1977). Nevertheless, according to Tilley (1989), absolute and complete objectivity is unattainable and so we need to be aware of the various influences and biases which may affect our interpretative abilities, and make appropriate accommodations.

3.7. The Applicability of Chaîne Opératoire to Embarras Bipoints

I have chosen only a few of the benefits and limitations of a chaîne opératoire to discuss and by no means exhausted the possible topics. I will attempt to address each of the following positive and negative elements as they relate to the study of Embarras Bipoints. The ones chosen for discussion, in no particular order, include use-life history, analytical depth, as an effective lithic analytical tool, experience, choice, and determining primary versus secondary technologies. To be fair, I will also address several of the restrictions of a chaîne opératoire which include scale, time and space restrictions, subjectivity, and action visibility.

3.7.1. Life-Use Histories

The chaîne opératoire approach allows us to explore the idea that, "objects accumulate histories and have the ability to tell multiple stories about people" (Gosselain 2000:189). These stories are directly linked to the people who made the objects and should be the prime goal of any archaeological analysis. This may be difficult to explore because of time depth, a lack of direct historical connection, or lack of ethnographic analogues. However, the study of techniques, more specifically the use-life of an object, is an attempt at understanding, "the complex set of feelings and relationships upon which identity is constructed [that] tends to be signified by the spatial distribution of stylistic content and steps of the manufacturing process"(Gosselain 2000:189). In other words, as an Embarras Bipoint progresses from a raw state to a finished product, the analysis of its chaîne opératoire may provide some insights into the social agency affecting its use-life.

Another point to be made regarding the use-life of an object is, "the longer the sequence of transformational stages an item goes through, the greater its chances of bearing social information" (David and Kramer 2001:185, discussing their interpretation of Wiessner's work with metal arrow heads). Not only can there be multiple use-life histories for an Embarras Bipoint, they can also be long and complex which makes for more fruitful interpretations. For example, curation can result in a particularly long and complex use-life.

Every object is fixed in time and space. In other words, every object was made, used, and discarded at a specific time and specific place. Bleed (2001:102) believes, "[an] operation may take no longer than the time needed to make and use a stone tool, but they have a specific duration with a beginning, an end, and a temporal direction". This means the use-life history of an Embarras Bipoint has a fixed beginning and end. Knowing the exact beginning and end of a use-life may be difficult to identify but acknowledging that they exist does provide some perspective for the chaîne opératoire of Embarras Bipoints.

3.7.2. Chaîne Opératoire Allows for In-depth Analysis of Artifacts

Another important interpretive value of a chaîne opératoire is the capacity for the in-depth analysis of an individual object. This is a fundamental aspect of the chaîne opératoire approach upon which both David (1999:17) and Lemonnier (1992:26) agree. The analysis of the technological actions involved in the manufacturing of a single object provides a great opportunity to similarly analyze another object or suite of objects. The chaîne opératoire approach forces the analyst to look at an object or a series of similar objects on a microscale (Dobres and Hoffman 1994:213). This in turn can provide useful information at a macro scale. The details, if approached on a microscale, may provide insight about an object that may not be seen at any other level of analysis. Ultimately, a hermeneutic-like approach is elemental to any good analysis where the whole is better understood by looking at its parts and/or the parts are better understood by looking at the whole.

3.7.3. Chaîne Opératoire is Useful for Restricted Technologies

Another aspect of operational sequencing is its inherent utility for studying the restricted schema, discussed earlier in the chapter, of lithic technology. There are not an infinite number of possible technological operations in the reduction sequence of a stone tool. The raw material, for example quartzite, cannot be fractured in an infinite number of ways and still be useful. The flintknapping tools, for example antler, will be prohibited by resource availability, thereby constricting the chaîne opératoire. Lastly, the objective, in this case the production of Embarras Bipoints, will further restrict the reduction sequence to only those actions which will achieve that objective. Thus, the chaîne opératoire of Embarras Bipoints, although complex, will not be confounded by an infinite number of possible actions.

3.7.4. Experience

Another positive feature of operational sequencing is dependant upon the experience of the analyst. The benefit of experience in the construction, and the value of the insights gained from operational sequencing are indisputable. The more experience one has with the production, use and/or analysis of Embarras Bipoints, the greater the chances of gleaning information from a chaîne opératoire type study. Experience with experimental replication, an integral tool in the construction of an operational sequence as is discussed later in this paper, can illuminate any subtle nuances within the chaîne opératoire. These insights can be compared and possibly considered analogous to the subtle nuances discovered and used by the original makers of Embarras Bipoints.

3.7.5. Choice

The purpose of a chaîne opératoire is to look at the techniques used in the production of objects. Each technique is composed of an action which is influenced by the choices made by the maker, based upon the four elements of an action. This ultimately influences the next action or event. In other words, the choice(s) made for one action will be predicated upon earlier actions or choices and in turn will affect the choices made later in the operational sequence. Being able to recognize choice(s) is best explained by Lemonnier (1986:155) who states, "if societies exercise 'choices' in a universe of possible techniques -most often unconscious choices, it goes without saying- these necessarily leave traces in the systems of representations, and the technical solutions retained must, one way or another, be in harmony with these latter".

This concept of seeing choice(s) is further elaborated upon by Hassan (1988:281) who states, "artifacts are to be regarded not simply as products of manufactural techniques fashioned for some utilitarian or symbolic function, but more properly as exemplification of [structured] cognitive processes". Hassan goes on to say, "the role of cognition, and memory—ideas of design—is essential for the making of lithic artifacts" (Hassan 1988:282). Cognition, ideas of design, and mental conception are all determined by choice. These choices are reflected in the actions taken and should be manifested in the chaîne opératoire. So, by examining the choices made during the manufacturing process, we can better understand concepts such as, habitus (Bourdieu 1977), of the people who manufactured Embarras Bipoints.

3.7.6. Primary versus Secondary Technology

Primary technology or primary performance characteristics have been defined by Schiffer and Skibo (1997:39) as, "an ideally weighted performance characteristic whose threshold value must be reliably reached in order to permit or cue any interaction during downstream activities". This is contrasted with a secondary technology which Schiffer and Skibo define as, "a process of fine-tuning an artifact's design so that it can facilitate countless interactions… secondary technology tend to favor technical choices having largely benign effects on primary performance characteristics" (Schiffer and Skibo 1997:41). Primary and secondary technologies have been also been referred to as essential and accessory technologies by Hassan (1988:286), and, strategic moments and, technical variants by Lemonnier (1986:154-55). In other words a primary performance characteristic is an essential action which must be completed, to within a defined parameter, before the next action can be initiated. A good example of a primary technology or performance characteristic would be the setting up of a sturdy, almost isolated, platform in order to produce a large comedial soft hammer percussion flake on a quartzite biface. A large comedial soft hammer percussion flake cannot be removed unless the platform can withstand the energy transfer between the percussor and the biface. So, the initial platform has to be well made in order to remove the flake which will affect the setup and execution of the next action. A secondary technology would be, for example, the use of a hard wood percussor versus a moose antler percussor. They will produce varying results but will not ultimately affect the essential characteristics of producing a large comedial soft hammer percussion flake on a quartzite biface. The differentiation between primary versus secondary technologies and how, "a technical choice can affect performance characteristics in many activities along an artifacts behavioral chain" (Schiffer and Skibo 1997:31), could, for example, be used to look at the isochrestism (Sackett 1977, 1982, 1984, 1985, 1986, 1990), of Embarras Bipoints.

3.7.7. Other Questions that can be Examined Using Chaîne Opératoire

There are a number of other useful elements of operational sequencing which could be considered but will only be mentioned here. One can create a chaîne opératoire to look at how techniques diffused or were innovated through time and space. Another positive element of a chaîne opératoire study would be the ability to examine similarities and differences in various raw materials and how this affected the acquisition, choice, and use–life of a stone tool. One could also address the stylistic and/or functional aspects of stone tools (for example Gunn 1977; Sackett 1977, 1982, 1984, 1985, 1986, 1990; Wiessner 1983, 1984; and Wobst 1977). Clearly, there are numerous analytical avenues that can be taken using the chaîne opératoire approach.

3.8 Some Issues with the Chaîne Opératoire Approach

Although a chaîne opératoire can be decidedly useful in many situations, some of the negative characteristics of the approach need to be addressed. Examples of negative characteristics of the chaîne opératoire approach would include; complexity and redundancy, context, subjectivity, the differentiation of style versus function, and the visibility of an action. This list of limitations is by no means complete.

3.8.1. Complexity

The chaîne opératoire of an object, in this case Embarras Bipoints, can become too complex to be useful. This means that there is no defined limit to the effort and/or variables which could be included in an operational sequence. The inclusion of every minute detail may not, in fact, be relevant and consequently hinder the overall understanding of a chaîne opératoire. This is a point upon which both David (1999:17) and Lemonnier (1992:26) agree. There are no hard and fast rules defining what a well-developed chaîne opératoire should be. The most important point is that the chaîne opératoire must be inclusive and conclusive enough to be useful and facilitate the best understanding but should not be overwhelmed by redundant variables which may lead to confusing results.

3.8.2. Context

The analyst, in almost all cases, is removed in time and space from the construction, use, and discard of the material culture s/he is studying. There are 5,000 to 7,000 years between the present study of Embarras Bipoints and the time these tools were a dynamic component of a culture. This time lag will affect what can be learned about these stone tools. There has to be a willingness to accept the fact that not everything can be known about material culture and the people who made it. This may be defeatist but needs to be addressed in order to produce a solid foundation upon which all analysis stands.

3.8.3. Subjectivity

Since a chaîne opératoire is the reconstruction of the sequence of actions an object goes through from a raw state to a finished product, the analyst has to determine which actions have worth and should be recorded. If one believes in a community of practice (Whittaker 2004:113-114), then the values chosen by the analyst will be similar to those of the maker, but this may not always be the case. For example, a chaîne opératoire could be too simple if the analyst finds most actions not worthy of consideration. Conversely, the operational sequence can be bogged down with irrelevant actions because the analyst is unwilling to eliminate any of them from the study. Familiarity with the material culture being studied and a willingness to include or exclude certain actions is something the analyst has to address.

Hodder states, "whether an artifact does or does not 'reflect' a particular type of interaction or information flow depends upon how it comes to be used as part of the strategies and ideologies of particular groups" (Hodder 1982:69 as quoted in David and Kramer 2001:192). This statement is interesting because what we as archaeologists deem worthy of information may be devoid of information from the perspective of the people making and using an object. For example, one could assume typical stone end scrapers found in just about all places and all times will have stylistic components or value for the people who made them. Yet, according to Meltzer (1981) an end scraper has no stylistic attributes and is made up of only functional components. Subjectivity, like context, needs to be kept in check or any results from a chaîne opératoire will be tainted.

3.8.4. Style versus Function

Throughout the 1980's and 90's one of the hot topics in archaeology involved the differences and similarities between style and function. Reading the literature, one becomes very aware of the pitfalls of trying to determine style versus the functional choices in producing an object. For example, Wiessner (1983:256, 257) in her works with the !kung San of Africa considers there to be both emblemic and assertive types of style. The question becomes how can one see and understand these types of style in stone tools from the Early Middle Period? Even with the benefit of a time machine one could easily confuse the different types of style with function and vice versa. In her defense, Wiessner had the opportunity, ethnographically, to confidently show the various types of style (Wiessner 1983, 1984), but in the study of Embarras Bipoints there is a need to be cautious.

3.8.5. Visibility of an Action

One has to be constantly aware of the evidence of actions that may have been eradicated during the manufacturing process of an Embarras Bipoint. The terminal stages of stone tool reduction that are required to finish an object will in most cases obliterate the evidence of previous actions. This is a natural progression when working with stone tools. So, if there is a commitment to creating a chaîne opératoire, then one has to be willing to look at the debitage in order to understand the early and medial stages. One of the goals in the analysis will be to search for residual evidence of the earliest actions on the finished product.

3.9. The Research Applicability of Chaîne Opératoire

The next section of this chapter will be to examine some of the research areas where operational sequencing can be most beneficial. The areas that benefit most from the chaîne opératoire approach are ethnoarchaeology, and experimental archaeology. Regarding ethnoarchaeology, I will only provide a brief discussion and a list of scholars who are using chaîne opératoire approaches. I will then focus most of my attention on experimental archaeology.

3.9.1. Ethnoarchaeology

Some examples of the ethnoarchaeological studies involving operational sequencing and lithic technologies include modern Lacandon Mayan lithic practices (Clark 1991), Kreober’s work with Ishi (Kroeber 1961), making Alyawara stone tools in Australia (Binford 1986; Binford and O’Connell 1984), stone tool making in the Sandover region of Central Australia (O’Connell 1977), other stone tools in Australia (Hayden 1977; Hiscock and Attenbrow 2003; and Isaac 1977), stone tool production in Irian Jaya, New Guinea (Stout 2002), scraper production and use in Ethiopia (Weedman 2000, 2006) stone bead making in Khambhat, India (Roux et al. 1995, Kenoyer et al. 1991), bead manufacturing practices in Arikamedu in India (Francis Jr. 1991), and modern flintknapping (Whittaker 1992, 2004; Flenniken 1984).

If the situation warrants, or if it is even possible, all replicative studies should include an ethnoarchaeological component. Unfortunately, for the study of Embarras Bipoints there are no modern ethnographic or ethnoarchaeological analogs with a direct relationship because the people who made Embarras Bipoints vanished 5,000 years ago; therefore, any ethnographic or ethnoarchaeological data can only be used indirectly. To counter this, I will rely heavily on experimental archaeology and the modern flintknapping ethos to supplement the chaîne opératoire.

3.9.2. Experimental archaeology

The area that will be the most useful for the construction, as well as interpretive potency, of a chaîne opératoire is going to be experimental replication of Embarras Bipoints. I have compiled a number of research projects dealing with the various stages of production as a cursory example of the experimental work that has been done by others. Their relevance to Embarras Bipoints may or may not be directly relevant to this study but are important to understanding the various stages of stone tool production. The research includes treatment of quartzite (Bamforth 2006; Crabtree 1967a; Dawe 1984; Ebright 1985; Finnigan 1983; and Knight 1989), early hominid stone tool techniques (Leakey 1950), boulder-on-boulder or bipolar technique (Low 1997; Steuber 2008; Wayland 1950), bifacial technology (Bradley 1974), hard hammer percussion (Speth 1974), tools for making stone tools (Cobb and Pope 1998; Crabtree 1967b, 1970), raw material selection (Crabtree 1967a), quarrying (Ahler et al. 1983; Burton 1984; Deaver 1988; Hampton 1997; Petraglia 1994; and Pitblado et al. 2007), refitting (Leach 1984; Petraglia 1994; and Torrence 1989) and other flintknapping techniques (Crabtree 1966, 1968, 1982). Once again, this list is only an example of the research which has been useful for the experimental study of Embarras Bipoints.

There are several reasons why replication will be helpful to better understand the archaeological environment of Embarras Bipoints. Firstly, the replicative process is fixed in time and space. Each action has a definite beginning and end. This will be useful for comparisons with the archaeological data set to determine how much time and effort is required at each stage of Embarras Bipoint production. This information can then be used to make analogies regarding the use of time and scheduling by the Embarras Bipoints flintknappers.

Another positive aspect of the experimental work is that it will establish a known comparative data set or sequence to work from. The experimental exercises will produce a known series of events or actions which can be compared to the archaeological data set. This will be useful for establishing any similarities within the archaeological sequence, as well as identifying any differences. The differences and similarities within the chaîne opératoire will help to address any of the cultural agencies which may have influenced the archaeological data set. The results of the experimental work can also be used to redirect future experimental work in a more productive direction. Ultimately, the experimental work will establish a number of different scenarios that can be examined to determine which one or ones was the chaîne opératoire used to make Embarras Bipoints.

Experimental research will also be useful because modern flintknapping techniques produce results similar, if not identical, to those found in the archaeological record. No matter how varied the overall reduction process(es) may be, there will be general overlaps between the archaeological and the experimental data sets regarding the different reductive techniques. In the same vein, the materials used for flintknapping tools, for example billets and pressure flakers, in the experimental component may not be exactly the same as those used in the past but for the most part there will be overlaps. So, in order to understand the different types of debitage being produced, the analysis will have to examine both the different reductive techniques as well as the various tools which can be used. This will be useful for making analogous comparisons regarding the choice of reductive techniques and flintknapping tools made by the producers of Embarras Bipoints.

Another benefit of the modern replicative study is the collective knowledge about the raw material. Living in the age of worldwide internet, it is easy to contact people who have or are studying identical or similar materials. This replicative project also has the benefit of previous geological research conducted in the study area (i.e. Roed 1968). This means the study of Hinton Conglomerate Quartzite and other similar toolstones will be greatly simplified by the research done by others. The research and experimental use of quartzite will be useful for making analytical speculations on Precontact use and patterning of the landscape.

The last idea about experimental replication to be discuss is also the most difficult to explain. Modern flintknappers are in a unique position to understand lithic artifacts. Regardless of time or culture, flintknappers share a common ethos. This ethos is composed of several integral perspectives and values. For example, Precontact and modern flintknappers have a value for the economy of stone (Whittaker 2004:227). Each group can have a different type of value placed on a lithic material but that value will still be equal. To take this one step further, a black fine-grained quartzite today may be preferred for aesthetic purposes while in the past the same stone may have been used because it was an expression of power or prestige. Although these values are significantly different, they both have an intrinsic value that is equal.

This common ethos can also be seen in the desire or need for stone tool manufacturing both in the past and in the present. There is no doubt that modern flintknapping may not serve as vital a purpose, for example eating and protection, as compared to the past. Nevertheless, there is definitely a movement within North America, and possibly elsewhere, where modern hunters are returning to more traditional stone tipped arrows and atlatl darts. The desire of modern flintknappers to use stone tipped projectiles can be seen as less 'functional' and more 'esthetic' or 'knowledge based'. The aspiration to produce, to excel, to push the boundaries and understanding of the craft has created a sub-culture of passionately devoted artisans who are producing masterpieces in stone. There are a number of very dedicated men and women around the world who have committed their lives to the study and replication of stone tools. Without any firm evidence, I believe this phenomenon could be extended to people in the past. This is not an idea that can be substantially proven without further discussion. But, one only has to read John Whittaker's (2004) book on the modern phenomenon of flintknapping in America to see the amalgamations between modern and precontact flintknapping ethos.

The last point I wish to make about the benefits of replicative experiments and chaîne opératoire is the symbiotic relationship between the deductive nature of flintknapping and the constructive nature of the chaîne opératoire approach. The fact that flintknapping can only be done in one direction, i.e. from raw state to finished product, can be counterbalanced by the additive approach of a chaîne opératoire. A completed chaîne opératoire allows the analyst the opportunity to put the stone tool back together, so to speak, and to retrace the reductive actions from a whole new perspective. The opportunity to see an action as it relates to the other actions in a sequence from two completely different perspectives will be beneficial to the overall interpretation of Embarras Bipoints.

There are a number of areas of experimental archaeology not discussed. Some of these include the use of other lithic materials for comparative purposes, the short sightedness of the researcher which may influence the impending results, the appropriateness or validity of one experimental chaîne opératoire versus another, and the use of thermal alteration. Future work with both experimental replication and the Embarras Bipoint, regardless of the work done in this thesis, will definitely be required to address these and other topics.

3.10. Concluding Remarks

The goal of this chapter has been to establish the theoretical framework for a chaîne opératoire approach to studying Embarras Bipoints. To meet this end I provided a brief history and a number of different definitions of chaîne opératoire as it relates to stone tools and more specifically Embarras Bipoints. I looked at some of the people who are using the chaîne opératoire approach. I provided a preliminary look at the overall process of a chaîne opératoire by segregating and providing an explanation of an action as well as for the entire sequence. I addressed some of the areas where operational sequencing would be useful such as in ethnology, ethnoarchaeology and experimental research. I focused my attention on experimental archaeology because I believe this will be the most appropriate venue for using chaîne opératoire to study Embarras Bipoints. All of this was done to show that the anthropology of techniques and experimental work will be the most appropriate theoretical approach for the elucidation of both Embarras Bipoints and the people who created them.

Chapter 4:
Defining Embarras Bipoints and a Discussion on Quartzite.

4.1. Introduction

This chapter is divided into two main sections. The first half of the chapter is a synopsis of the previous research that has been done with Embarras Bipoints. Following is a discussion of the function or purpose of Embarras Bipoints. Third, is a discussion of the defining characteristics that make Embarras Bipoints unique. A detailed description of the each of the Embarras Bipoints used in this thesis can be found in Appendix B. The last part of the first section is the description a number of stone tools that could possibly be Embarras Bipoints.

The second half of the chapter deals with the raw material, quartzite, used to make Embarras Bipoints. A thorough examination of this unique, and understudied, material will be undertaken for two reasons. First, this is a critical step in developing the operational sequence of crafting Embarras Bipoints. Second, this toolstone is ubiquitous to many of the archaeological sites in Alberta and beyond, yet remains one of the least studied and therefore, least understood type of toolstone. Quartzite is a material that can be used to make many different tool types, but takes a real mastery of flintknapping to produce quality tools like Embarras Bipoints. Thus, understanding the toolstone is the first step to better understanding the chaîne opératoire of Embarras Bipoints.

4.1. A History of the Research on Embarras Bipoints

Prior to 2002 various consulting companies in Alberta had unknowingly found a significant number of the Embarras Bipoints considered in this thesis. Following 2002 a number of Embarras Bipoints were found in the Hinton, Alberta area and it became obvious that there was something unique about these as yet unnamed artifacts, (e.g. Figure 4.2). In 2003 D. Meyer felt these tools were worth naming:

> The one tool type defined previously that has proven to recur in other contexts in the Weldwood FMA is the Embarras Bipoint (Meyer 2003). Early in the 2003 season, the recording of a Precontact quarry/workshop in disturbed contexts on the Embarras Plateau in the vicinity of the Lovett River produced another finished example of an Embarras Bipoint, albeit somewhat smaller than the original two from nearby sites FgQf-62 and FgQf-16. Over the course of the field season, a total of 5 Embarras Bipoints or possible fragments were recovered from 4 different sites spread across the Weldwood FMA (Plate 130). In addition to the 7 specimens of Embarras Bipoints now known from sites encountered during HRIA work on behalf of Weldwood, a review of previous work has turned up several other examples in the general area (Table 8, Plate 134). These include examples from FgQe-16 along the Lovett near Coal Valley (Calder and Reeves 1977), FhQg-2 at the confluence of the Embarras River and Dummy Creek (Calder and Reeves 1978), two possible examples from FhQf-10 in the vicinity of Robb (Hunt 1982), FiQi-1 along McPherson Creek (McCullough 1982), and a possible example from FiQq-8 in Glacier Pass in Jasper National Park. This last example is described as "asymmetrical lanceolate," but then interpreted as discarded due to areas of fracture along both edges (Anderson and Reeves 1975). With some exceptions, perhaps due to differences in terminology, analyst interpretation, or actual differences, all of these tools share roughly similar general descriptions.
>
> Based upon the two Embarras Bipoints collected previously (Meyer et al. 2002; Meyer 2003) and the 5 new examples collected during the 2003 season, a new description of these artifacts is provided here. Overall, the Embarras Bipoint can be characterized as an ovate, bipointed biface, biconvex in cross-section, with biconvex or excurvate, typically sinuous or wavy edges. Some examples show one end as somewhat more rounded than the other more pointed end. Both faces have typically been flaked, but the ventral side is generally less modified. Comedial percussion flaking with some edge flaking is commonly noted. Interestingly, comedial pressure flaking is common to Cody Complex projectile point production (Bradley 1993). Given the size of the first examples collected, it was believed they may have been produced from split quartzite cobbles. However, examples from this year and re-examination of previous finds have located remnant platforms and bulbs of percussion along the lateral edges, suggesting that these bifaces were produced on large, wide, ovate, "fan" flakes produced as the result of soft hammer percussion. One possible example of such a flake/early stage biface was recovered at FlQi-3 (FlQi-3-175, Plate 130: F, see Appendix A). Raw material is typically quartzite, although a single possible example from Jasper National Park is a silicified sediment.
>
> The two examples collected in previous years have almost precisely the same dimensions, and are considerably larger than the examples collected this year. Initially, this suggested that two potentially discreet size types would be identified. However, inspection of the available metric data (Table 8) finds

> considerable variability in terms of size, but representing a fairly discreet range. Length ranges from about 9 to 13 cm, with an average of almost 11 cm. Width ranges from about 4.5 to 6.5 cm with an average of about 5 cm, and thickness ranges from about 1 to 2.5 cm, with an average of about 1.5 cm. Given the current small sample size, the collection of additional specimens will be required before a determination can be made of either a single type representing a range of sizes and/or potential use-life histories (i.e. use and resharpening resulting in smaller specimens), or clear size differences perhaps representing sub-types of the Embarras Bipoint.
>
> (Meyer 2003:202-03)

From 2003 to the present, the number of Embarras Bipoints has grown and will hopefully continue to grow (See Table A.1).

4.3. What are Embarras Bipoints?

One problem with the name Embarras 'Bipoint' is the word bipoint can be misleading for several reasons. As well, not all Embarras Bipoints are bipointed. A number of examples are more ovate, some are oval shaped, and others are asymmetrically bipointed. Also, the name bipoint for many implies projectile point and that is not what these tools were used for (at least this is my understanding at this point in the analysis). In the future it may be shown that these artifacts were in fact used in a projectile system. However, the projectile system, be it the atlatl, spear, and/or bow, would have to be much larger and heftier than any I know. The present interpretation is that Embarras Bipoints were hand held tools used in activities like cutting, scraping, and gouging (See Figure 4.1). The best explanation of their purpose has to be as a multi-purpose tool. The most common toolstone used to make Embarras Bipoints is quartzite. Quartzite is a technologically challenging material to work but produces a very durable edge. In areas where there is good quartzite, but availability is impaired by physical and chemical degradation of the toolstone, large solid pieces become valuable. As a valuable commodity, a good solid piece will be used to its fullest extent. The most economical use would be as a core tool that could produce usable flakes for smaller more delicate work and still have a large working edge for bigger jobs. This may be why there are a high percentage of large thinning flakes seen on Embarras Bipoints. This could also explain the overall size similarities of these tools (see Table A.1).

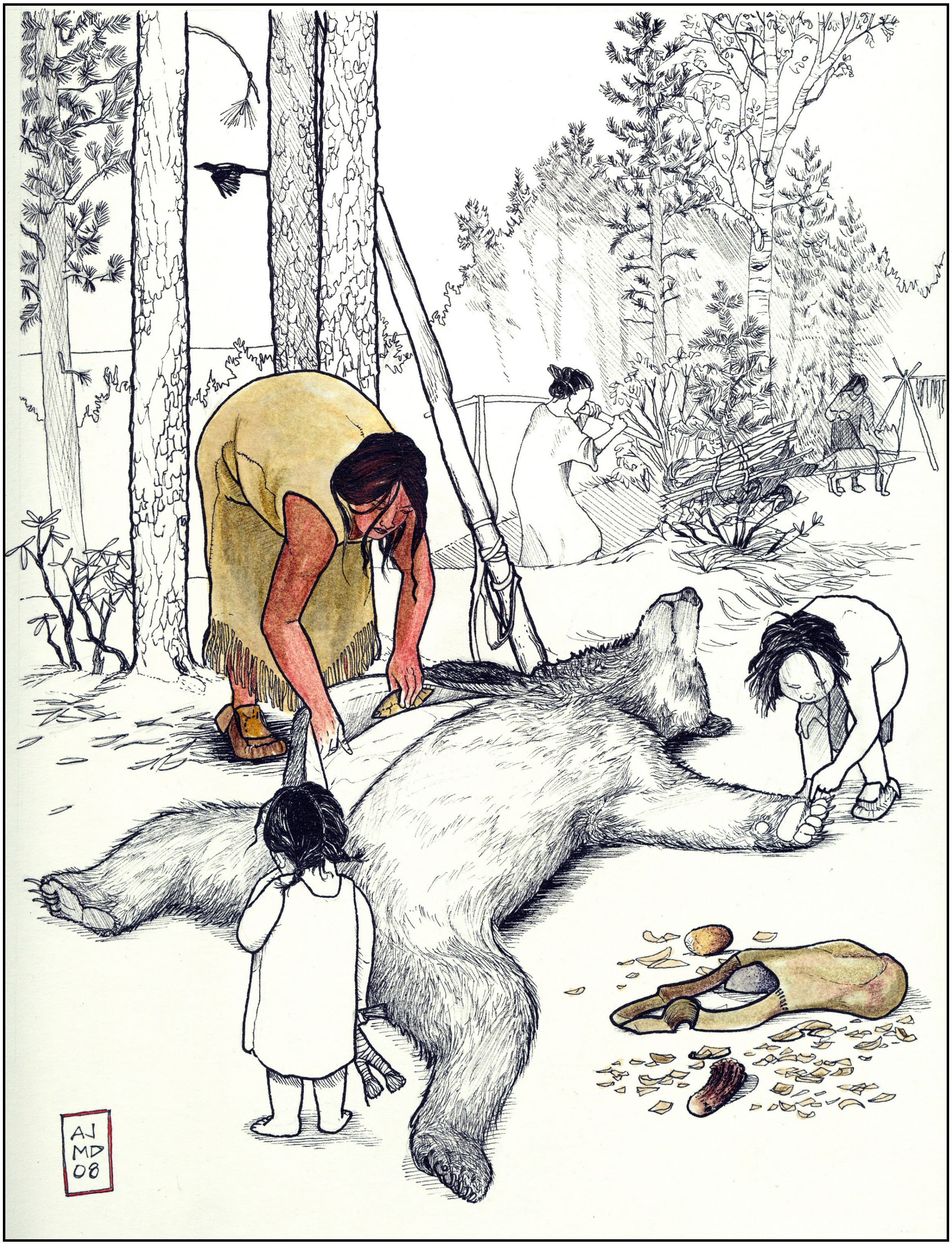

Figure 4.1: Artistic Reconstruction of Embarras Bipoint Being Used (AJMD 2008)

4.4. Why are These Tools Bipointed?

There are four possible reasons why Embarras Bipoints are typically bipointed, in overall shape: (1) cultural preferences, (2) the physical constraints of the toolstone, (3) a function of use, or (4) a combination of these reasons. There are other possible reasons why the tools are bipointed but they should fall into one or more of these generalized categories.

The cultural practice of shaping these tools is definitely one of the more difficult to address. The overall shape (See Figure 4.2) could be culturally determined for any number of reasons and we, as archaeologists, will never truly know them all. One could predict that the shape of Embarras Bipoints was iconic. The shape could increase their value as a trade commodity. One could suggest that habitus (Bourdieu 1977; Silliman 2001) dictated the shape; in other words, they were just always made that way. The exploration of the cultural practice of shaping these tools is an exciting avenue to investigate but pessimistically the results may never be more than guesses.

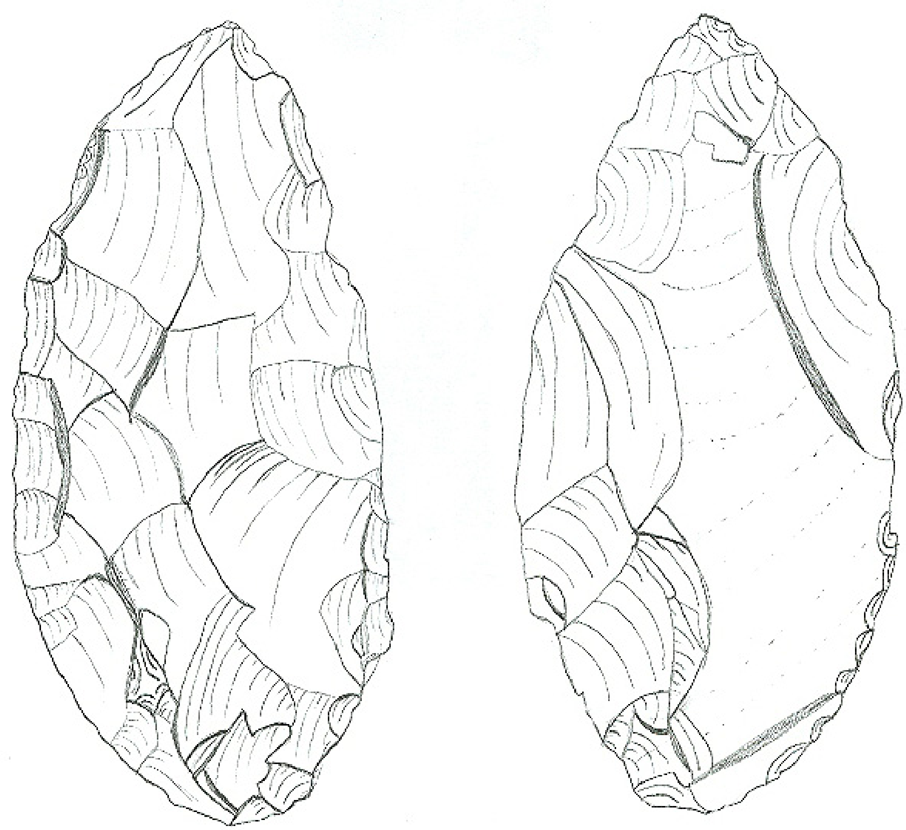

Figure 4.2: Drawing of an Embarras Bipoint (FgQf-16-1)

A more pragmatic explanation, from the perspective of a flintknapper, is that the shape of these tools was dictated by the physical constraints of the toolstone. The narrower proximal and distal ends, the points, facilitated the thinning process. Quartzite is difficult to work, there can be internal fractures and the flake-ability can be taxing. Producing a tool with narrower points reduces the chances of creating flaws in the tool. Also, working the proximal and distal ends more intensely increases the chances of getting flakes to travel across the longitudinal axis of the piece. Conversely, the shape could be explained as simply being the result of uni-directionally thinning a split cobble into an effective tool with the least amount of effort.

The most plausible reason that Embarras Bipoints are bipointed could be a result of function. The most likely purpose of Embarras Bipoints was as a multi-use hand held tool. The ludicrous but apt 'fits well in the hand' argument may be applicable. One shape that allows for the firmest grip, on a sharp edge, is convex because it minimizes the focal points between the sharp edge and the hand. Along the same vein, the shape could be a reflection of use, meaning an excurvate edge with bipointed ends was best suited to fulfilling a specific purpose or task. These purposes or tasks would have to be important enough for all the Embarras Bipoints to be made in a similar fashion. However, the shape seems best suited for performing a multitude of tasks, seeing it was most likely a multi-functional tool.

Not all Embarras Bipoints are strictly bipointed which can cause some confusion. One of the solutions to the moniker confusion would be to refine or change the name all together. Even Daniel Meyer (personal communication, 2003), who named these tools, has voiced his concern about the confusion regarding the name. One possibility would be to call them Embarras Bifaces or Embarras Bipointed Bifaces. However, the term Embarras Bipoint was first coined by Meyer in 2003 and has been used since that time. To change the name at this point would not only be more confusing but also would disregard the historical precedence of the term and not give credit where credit is deserved.

The Embarras Bipoint is a, "polythetic" tool (Andrefsky 1998:65), where no one technological or morphological features is more important than the other. All of its features have an equal interpretive value and should be seen as parts of a whole. This does not mean if features are missing, incomplete, or obscure it becomes more difficult to use as a diagnostic tool. Quite the contrary, because each of the features on an Embarras Bipoint are equally important the tool can be broken with parts missing and the interpretive value of the tool maintained.

4.5 The Uniqueness of Embarras Bipoints

There are four key morphological and/or technological attributes, which make Embarras Bipoints unique: shape, size, material type and flaking pattern, (See Plates 1 to 20). The combination of these four traits makes Embarras Bipoints a sophisticated multi-purpose tool that requires a significant level of skill and knowledge to produce, use and maintain. These are not the only traits that make Embarras Bipoints unique, but ones that are consistently associated with Embarras Bipoints. Some of the other traits common to Embarras Bipoints will be discussed in the next section. However, each stone tool is unique with a different technological history and to expect all of these traits to be ubiquitous to all Embarras Bipoints would be unrealistic.

The overall *shape* is, as the name suggests, bipointed. This can mean the proximal and distal ends are symmetrically bipointed but also asymmetrically bipointed. One end can have a sharper point with the other more rounded. Both ends can have rounded points. In some cases the shape is ovate, elliptical, or oval which should exclude shape as a criterion or pertinent only when the other three key characteristics of Embarras Bipoints are present. A general rule would be the tool has to have a more or less bipointed planview appearance. In cross section, longitudinally or transversely Embarras Bipoints are almost exclusively bi-convex or plano-convex. Even though the faults and follies of making stone tools can obscure or make difficult the interpretation of these profiles, Embarras Bipoints always have either a bi-convex or plano-

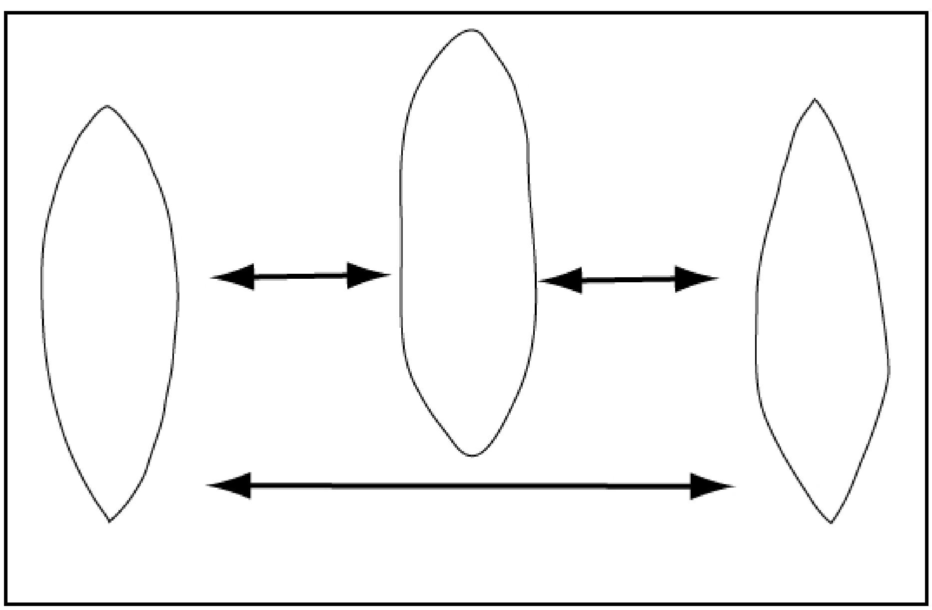

Figure 4.3: The Typical Shapes of Embarras Bipoints

convex cross section. The lateral edges are to some degree always excurvate from the proximal to distal end. The symmetry of the lateral edges may be skewed or asymmetric to the medial axis but they definitely do not have, for example, incurvate lateral edges. Lastly, the lateral edges will be to some degree sinuous or wavy.

The *Size* of most Embarras Bipoints is impressive when compared to most stone tools. The average length is 11 cm; width is 5 cm, and the thickness 1.5 cm.

Table 4.1: Complete Embarras Bipoints

Borden Number-Catalogue Number	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Dorsal to Ventral Ratio
DgPl-85	quartzite	100	47	8	n/a
DjPp-2	quartzite	85	38	8	n/a
EgPm-179	quartzite	142	45	12	2.5:1
EhPu-1	quartzite	90	35	n/a	n/a
FgQe-16-289	quartzite	128	50	9	1.75:1
FgQf-143-4	quartzite	99	48	9	2.5:1
FgQf-16-141	quartzite	130	66	25	1.9:1
FgQf-180	quartzite	70	50	n/a	n/a
FgQf-62-1471	quartzite	130	67	21	1.83:1
FhQf-10-1040	quartzite	89	46	15	1.25:1
FhQf-10-1210	quartzite	103	51	10	2.1:1
FhQf-10-1261	quartzite	90	47	12	3:01
FhQf-10-3	quartzite	94	52	11	2.2:1
FhQf-10-912	quartzite	82	58	14	2:01
FhQf-10-978	quartzite	93	47	15	1.5:1
FhQg-3-36	quartzite	82	56	10	3.2:1
FiQe-20-5	quartzite	129	69	18	1.5:1
FiQi-1-1	quartzite	113	48	10	n/a
FjQl-46-9	quartzite	86	49	13	1.3:1
FkQl-26-2	quartzite	130	86	22	3.7:1 (*)
FlQh-12-3	quartzite	118	81	25	2.2:1
FlQj-29-2	quartzite	119	71	27	3.7:1 (*)
GbPv-1-585	quartzite	69	45	11	n/a
GbPv-1-897	quartzite	76	46	14	n/a
North Star Road surface find	quartzite	117	63	21	1.5:1

*incomplete tool

This clearly shows that the Embarras Bipoint is a large stone tool even when compared to other characteristically large stone tools. The reason Embarras Bipoints are a relatively large tool could be related to cultural and/or functional preference, or a consequential result of using quartzite as a primary toolstone. In any case, size is one the most obvious traits that makes Embarras Bipoints unique.

Material type is significant in that all of the examples have been manufactured from locally derived toolstone. The material used for most specimens was quartzite and to a lesser degree materials such as Nordegg Member Silicified Siltstone, Banff Silicified Siltstone, Glacier Pass Silicified Mudstone and other equally knappable toolstones. The choice of material from local sources is interesting because the various properties of quartzite may have cultural significance. The idea of culturally influenced lithic procurement strategies would benefit from further consideration.

The most informative technological and morphological attribute of the Embarras Bipoint is the *flaking technology* used to produce the tool. All of the examples have large, random, comedial, soft hammer percussion flake scars. The sinuous edge, common to them all, is the result of removing flakes with edge bite platforms. An edge bite striking platform can be created by soft hammer percussion where the flake initiates in from the lateral edge (discussed in greater detail in Chapter seven). Most importantly, all the Embarras Bipoints have a more complex scar patterning on the dorsal surface as compared to the ventral surface. The flake scarring on the ventral surface is related either to shaping, the removal of the bulb of percussion, or platform preparation for removing flakes from the dorsal surface. The flakes on the ventral surface are more random, focused along the lateral edges and usually have step or hinge terminations. The significance of a dorsally focussed reduction sequences is that a desirable cross-section was achieved relatively early in the manufacturing process and/or was obtained with a minimal amount of modification. The focus of the analysis, experimentation and interpretation of Embarras Bipoints in this thesis will be tethered to the technological significance of Embarras Bipoints.

4.6. Other Attributes Which Make Embarras Bipoints Unique

Embarras Bipoints have other unique characteristics. The overall *width to thickness ratio* of complete Embarras Bipoints denotes that thinness was a desired end result. Thinness versus thickness is a very subjective analytical observation, so this quality cannot be used in isolation. Qualifying how thin a tool is implies that thinness should be a desired outcome or a characteristic of a quality made tool. The width to thickness ratio is an observation without prejudice because the larger the stone tool the more robust the cross section. When compared to other stone tools, for example projectile points, Embarras Bipoints are thick in cross section. Their thinness becomes more apparent when comparing the ratio of length and width to thickness, or to other stone tools of the same size. More research on the width to thickness ratio might prove this insight to be insignificant or incorrect.

One technological trait of working quartzite is the need for sturdy striking platforms. As a result there is a propensity for edge bite flake scarring along the lateral edges creating their sinewy appearance. Whittaker (1994:190) has defined an edge bite flake as,

> thin and flat, an ordinary biface thinning flake but with an exaggerated lip. The initiating fracture was not near the point where the hammer struck the platform (the edge of the biface), but even further in than usual. […], the platform on the edge is made to strong to allow a fracture to start there, or the blow falls too far from the edge.

Almost all of the Embarras Bipoints observed for this thesis exhibit lateral edges with a slightly to very obviously sinuous appearance. This will be discussed in more detail in Chapter 7.

Another interesting trait of Embarras Bipoint is they appear to be fashioned almost exclusively with soft hammer percussion flaking. However, the makers could be using hard hammer percussion in the earliest stages of reduction for striking platform construction, or employing hard hammer percussors using soft hammer techniques. This means they would be using more friable or softer stone percussors in a similar way to an antler or wooden billet.

There does not appear to be much use of pressure flaking in the manufacturing of Embarras Bipoints. This might be an observational error, but more likely is tied to the flakeability of quartzite. From personal experience, as well as talking to other accomplished flintknappers, quartzite is not the easiest material to pressure flake (Don Hanna 2008, personal communication). This does not mean pressure flaking cannot be used to produce smaller flakes and finer edge retouching, but the chances are nearly impossible that pressure flaking was used to produce the large thinning flakes found on the dorsal surfaces. Another accomplished flintknapper, Eugene Gryba of Calgary, can and does knap tougher material like Swan River Chert and quartzite using pressure flaking but even his results, i.e. finished tools, do not have the same size of flaking as is found on Embarras Bipoints (personal observation).

One early observation about Embarras Bipoints was the appearance of a *remnant platform* along the lateral edge, on either the proximal or distal end, that was associated with the original spall or blank. This remnant platform was believed to be part of large fan flakes that were the ideal spalls or preforms for making an Embarras Bipoint. This explains why in the 2003 Weldwood H.R.I.A. report, the description of Embarras Bipoints states, "examples from this year and re-examination of previous finds have located remnant platforms and bulbs of percussion along the lateral edges, suggesting that these bifaces were produced on large, wide, ovate, 'fan' flakes produced as the result of soft hammer percussion" (Meyer 2003:203). Since that time and with further analysis, experimentation, and observations on newly found Embarras Bipoints, this interpretation has changed. Through examination of the flake scarring on and around the 'platform' one can see that what was initially considered to be a 'platform' is in fact a heavily prepared lateral edge with a large percussion flake removed from adjacent to or across from the prepared edge, creating a lipped appearance and, therefore, a remnant platform-like feature. The most recent interpretation proposed in 2003, and one most likely is that Embarras Bipoints are made from split cobbles. This thesis will present arguments to provide support for this idea.

The last feature of Embarras Bipoints that makes them unique is not the tool itself but the suite of tools they appear to be associated with. There are technological similarities between Embarras Bipoints and other tools from the Early Middle Period such as Lovett Unifaces, Reverse Unifaces and Erith Knives. The argument can be presented that they were all made following a reduction sequence(s) that was drawn from a collective technological pool. For example, Reverse Unifaces are worked entirely on the ventral surface using large, random, comedial percussion flaking while Lovett Unifaces are almost identical except the flaking was done exclusively on the dorsal surface. To completely elucidate the significance of this technological phenomenon requires more work than is appropriate for this thesis and will be left to future research.

4.7. Description of Known Embarras Bipoints

A data set of known Embarras Bipoints and specimens that could be Embarras Bipoints was compiled for this thesis. All of these tools have been listed in Table A.1. and described in Appendix B This collection of tools was drawn from archaeological sites in and around the Eastern Slopes of Alberta and adjacent areas. Most of the specimens are from excavated and or surveyed sites that I had access to. Some of the Embarras Bipoints could not be examined because they were too difficult to locate, were lost, or in some cases, stolen. In these situations, photographs and written descriptions of the tools were consulted. Most of the photographs were clear and a number of the written descriptions had 'clues' to the tools' uniqueness. For example, Van Dyke and Stewart's (1985:218) image of the Embarras Bipoint from EgPm-179 is sharp, while Pickard's (1986:16) description of the two bipoints found near Jasper clearly notes some of the more prominent features of Embarras Bipoints.

Descriptions of each of the specimens can be found in Appendix B, but, one has to be cognizant of the fact that the descriptions of the Embarras Bipoints used in this study are incomplete. The intention was to highlight features and attributes of these tools that are consistent with the criteria mentioned in the previous section. For example, damage caused by excavation and/or analysis was not mentioned in these descriptions.

4.8. Description of Possible Embarras Bipoints

The following specimens are promising candidates to be Embarras Bipoints but have inconsistencies such as differences in morphology, reduction sequence, or are outside of my study area (see Table A.2). A more complete and comprehensive analysis of these tools could demonstrate that they are Embarras Bipoints.

FdPe-4 (Plate 21; Table A.2)

This interesting tool could possibly be an Embarras Bipoint. The size, shape, and visible flaking pattern (from the photograph) are consistent with other Embarras Bipoints. The toolstone used was mudstone, which is different than most Embarras Bipoints, but this is a locally derived resource so it falls into perimeters for being an Embarras Bipoint. The surface showing, most likely the dorsal side, has wide, random, comedial percussion flaking. The lateral edges are sinuous in cross section (Doll 1982:44, 149). Also, Reverse Unifaces and Early Middle Period projectile points have been recovered at this site (Doll 1982:51, 132, 157). The only reasons this specimen was not classified as an Embarras Bipoint was the difference in toolstone and not having the opportunity to examine the tool.

FfQh-26-2725 (Plate 22; Table A.2)

This refitted bipoint, made from Nordegg Member Silicified Siltstone, is a very strong contender for being an Embarras Bipoint. The only reason this tool has not been classified as an Embarras Bipoint is the toolstone used was not quartzite. This tool is sixty to seventy percent (60-70%) complete. The proximal portion is semi-ovate in overall shape. The medial edge of the proximal portion has a snap fracture along an internal flaw in the stone. The lateral edges are excurvate and converge towards the proximal end. The body exhibits wide, random, comedial, bifacial flake scarring. The proximal end of the proximal portion is rounded. The distal portion has a sharp exterior point that has been unifacially worked. The lateral edges are excurvate and converge towards the tip. The right, dorsal, lateral edge has been unifacially flaked on the ventral surface. The left, dorsal, lateral edge has unifacial edge flaking on the dorsal surface. The medial end of the distal portion has a snap fracture. The tool tested positive for deer antiserum indicating that it could have been used on deer, caribou, elk or moose (Meyer et al. 2007:83, 316).

FgQe-14-218 (Plate 22; Table A.2)

This broken Embarras Bipoint candidate, made from Nordegg Member Silicified Siltstone, has a rectangular planview shape and a plano-convex transverse cross section. One medial edge has a perverse fracture and the other has a snap-hinge fracture. The lateral edges are straight parallel. The body shows signs of wide, random, comedial, bifacial, percussion flake scarring (Calder and Reeves 1977:12, 43). The toolstone and bifacial flaking pattern are inconsistent with the traits of most Embarras Bipoints. However, there was an Embarras Bipoint, a Lovett Uniface, an Erith Knife, and an assortment of Middle Period projectile points found with this specimen.

FgQe-14-3139 (Plate 22; Table A.2)

This possible Embarras Bipoint, made from pink quartzite, has a bipointed planview shape and a plano-triangular transverse cross section. The tool is complete but is unusually small to be an Embarras Bipoint. The distal tip is sharp and pointed. The lateral edges are excurvate. The proximal end has been slightly rounded to a point. The dorsal surface shows the sign of random, percussion edge flaking but the majority of the proximal portion has been left unmodified. The ventral surface has only a light to moderate amount of edge flaking (Calder and Reeves 1977:15, 44). The size of this specimen, similar to FgQe-14-3271, makes defining it as an Embarras Bipoint difficult. However, an Embarras Bipoint, a Lovett Uniface, an Erith Knife, and an assortment of suitable diagnostic projectile points had been found with this tool.

FgQe-14-3271 (Plate 22; Table A.2)

This complete Embarras Bipoint contender, made from pink quartzite, has an ovate planview shape and a plano-convex transverse cross section. The distal end is squared off and appears unfinished. The lateral edges are straight to slightly excurvate from the distal towards the proximal end. The dorsal surface shows signs of wide, random, comedial, percussion flake scarring. The ventral surface has a wide, random, percussion edge flake patterning. The proximal end is rounded. The distal end and right, ventral, lateral edge towards the distal end is squared off indicative of the edge being unfinished. (Calder and Reeves 1977:14, 43) The overall size, which is comparable to FgQe-14-3139, is too small to classify this tool as an Embarras Bipoint. However, an Embarras Bipoint, a Lovett Uniface, an Erith Knife, and an assortment of Middle Period projectile points were found with this tool.

FhQe-13-2 (Plate 22; Table A.2)

This broken, potential, Embarras Bipoint, made from pink and orange fine-grained quartzite, has a trapezoidal planview shape and a plano-convex transverse cross section. The shorter medial edge has a perverse fracture and the longer one has an irregular snap fracture. The lateral edges are straight and converge towards the shorter medial edge. The body has been worked with wide, random, bifacial, percussion flaking (Meyer and Roe 2006:542, 549). The toolstone, shape and cross section are convincingly Embarras Bipoint traits but the flaking pattern is inconsistent with other Embarras Bipoints. This artifact was found within my study area so the possibility exists for it being an Embarras Bipoint. Further analysis will be performed with this specimen in order to classify this tool more precisely.

FhQg-2-179 (Table A.2)

This specimen has been nominated for several reasons. The artifact, made from grey fine-grained quartzite, has an ovate planview shape and a plano-convex transverse cross section. The distal end is round and sharp. The lateral edges are sharp and excurvate. The proximal end has a straight to slightly rounded appearance. The body has a wide, random, bifacial percussion flaking. There is no obvious used-wear on this tool (Calder and Reeves 1978:7-8, 31). The reason this artifact is possibly not an Embarras Bipoint is the overall shape and flaking pattern is not consistent with other Embarras Bipoint. However, two Embarras Bipoints (FhQg-2-608 and 609), and the, "tip of an atlatl or spear point" (Calder and Reeves 1978:6) were found with this artifact.

FiQq-8-103 (Plate 21; Table A.2)

This complete specimen, found in Glacier Pass of Jasper National Park (Anderson and Reeves 1975), has been identified as an Embarras Bipoint (Meyer 2003:202-03), but has been excluded here for two reasons. The toolstone used to manufacture this tool has been identified as Glacier Pass Silicified Mudstone. Almost all the examples of Embarras Bipoints have been made from quartzite. Secondly, I did not have the opportunity to study this tool, except in a photograph, and decided to not include this tool without further analysis. Nevertheless, this tool is pointed on both the proximal and distal ends. The lateral edges appear to be obtuse angled and straight to slightly excurvate. The dorsal surface appears to have wide, random, comedial, percussion flake scarring. The lateral edges appear to be sinuous (Meyer 2004:458). These characteristic are consistent with other Embarras Bipoints.

FkQk-9-36 (Plate 22; Table 6.2)

This specimen is the projected interpretation of a medial to late stage Embarras Bipoint preform. Made from a dark grey fine-grained quartzite, this complete preform has an ovate planview shape and a plano-convex transverse cross section. The distal end is rounded. The lateral edges are excurvate and converge towards the distal end. The proximal end is wider than the distal end and rounded. The dorsal surface has a wide, random, percussion flaking pattern with cortex along the longitudinal axis and distal end. The ventral surface shows signs of percussion edge flaking (Meyer et al. 2007:548; Meyer et al. 2008:510, 518). This specimen was included as a prototype of a medial stage or incomplete Embarras Bipoints but could very well be incompatible with these tools.

IfPo-1 (Plate 21; Table A.2)

This possible Embarras Bipoint was found, along a remnant beach terrace on the southeast arm of Wentzel Lake, west of Wood Buffalo National Park, in Alberta. The artifact is made of quartzite and has the requisite bipointed shape and size. The scar patterning on the dorsal surface appears to be made by large, random, comedial, percussion flaking. The ventral surface is not available because the photograph shows only one side. A large side-notched projectile point unique in shape but appropriately dated, was found with this tool. A date of 5220+/- 100 years before present was obtained from a collected charcoal sample from the site (Conaty 1977:31).

Fond Du Lac Site, surface find (Plate 21; Table A.2)

One of the surface finds from the small community of Fond Du Lac on the eastern shore of Lake Athabasca was a quartzite bipoint. Wright (1975:103) described the tool as, “a bi-pointed specimen with a marked plano-convex cross section”. From the photograph this tool clearly has the appropriate shape and size for an Embarras Bipoint. The visible surface, which appears to be the dorsal surface, has a wide, random, comedial, percussion flaking. Wright dates this bipointed quartzite specimen with another bipointed tool found at IgOg-2 to the same period of time (Wright 1975:103, 163).

IgOg-2 (Plate 21; Table A.2)

The site is located on Lake Athabasca near William Point and Beaver Point. One of the five bifaces recovered from this site has been described as bipointed (Wright 1975:121). From the photograph the toolstone used is unclear but could be a dark grey or black quartzite or possibly a silicified siltstone. The tool is clearly bipointed and the visible surface, which appears to be the dorsal surface, has a wide, random, comedial, percussion flaking pattern. Interestingly, Wright (1975:122) states that, "the bipointed specimen is more typical of the Taltheilei Shale Tradition" meaning both the Fond Du Lac bipoint and this bipointed artifact should have similar dates.

4.9. Quartzite

The second half of this chapter is dedicated to a discussion of quartzite. This will include a consideration of the reasons to look at quartzite, a definition of quartzite, the physio-chemical makeup of quartzite, the distribution of quartzite, the quarrying and heat treatment of quartzite, and briefly the economy of stone. The chaîne opératoire of Embarras Bipoints is the study of these objects from a raw state through to a finished form and ultimately their discard. Understanding the raw material should provide some useful insights to the later stages in the operational sequence and possibly even behavioural traits of the people who made Embarras Bipoints. Questions can be asked such as, why where people using quartzite to make Embarras Bipoints? Was quartzite a primary factor influencing decisions to move in and out my study area? Was this resource, as well as others, sufficient to keep people in the area? The purpose of these discussions will be to show that quartzite was an excellent material for making Embarras Bipoints and may have been important enough to draw Embarras Bipoint makers to the Eastern Slopes more specifically, the Hinton area.

4.10. The Reasons for Looking at Quartzite

For almost all of the known Embarras Bipoints, quartzite was the toolstone of choice. This is why to be consistent in terms of experimentation, replication, analysis, compatibility, comparability and usefulness, my replication study needed to use quartzite. Using another lithic material for the experiments would only introduce a set of new variables that might, or might not, be consistent with quartzite. Quartzite, as most flintknappers and archaeologists will agree, is not the easiest material to work and/or analyze. Initially, I felt that if, in the course of the experimentation and analysis, there were amorphous or difficult morphological features on either the quartzite tool or debitage that would benefit from a comparison to another material then I would use other toolstone(s). However, after completing the experiments and analysis of the tools and debitage there was no need to incorporate other toolstone(s). Another reason for looking at quartzite is that a high percentage of the assemblages from sites with Embarras

Bipoints, as well as sites without Embarras Bipoints, in my study area consist of quartzite artifacts. A last reason for studying quartzite is because there appears to be very little research done on it. This is a point that Pitblado et al. (2007:13) agree with.

4.11. Quartzite Defined

Quartzite is one of the most common toolstones found on Precontact archaeological sites in the Foothills area. Identifying the qualities of the material may prove useful for understanding why it was such a common toolstone. According to Howard (2005:707), "quartzite should be classified descriptively as both a sedimentary and a metamorphic rock". In other words, quartzite is metamorphosed sandstone, meaning beds of sedimentary sandstones under certain temperature and/or pressure changes will transform into quartzite. B. Pitblado et al. (2007:14) have proposed that quartzite can be subdivided into two main types: (1) orthoquartzite and (2) metaquartzite.

Orthoquartzites can be either, "diagenetic (sedimentary) or of low-grade metamorphic origin" (Pitblado et al. 2007:14), or, "a type of supermature sandstone containing >95% quartz" (Howard 2005: 708). In other words, orthoquartzites are sandstone deposits infused with cementing agents, such as degrading silicates, that have been physically and chemically altered by metamorphism. Examples of regionally relevant orthoquartzites include Beaver River Silicified Sandstone (Fenton and Ives 1982; Ives and Fenton 1983; Saxberg and Reeves 2003:292, the toolstone is currently being renamed but will be called B.R.S.S. because of historical precedence). Also present on the northern plains is Tongue River Silicified Sandstone from Montana and the Dakotas (Ahler 1977; Porter 1962). Examples of orthoquartzites that are a bit further afield include Roubidoux Quartzite from Missouri (Waldorf and Waldorf 1987:16) and Hixton Quartzite/Silicified Sandstone from Wisconsin (Gregg and Grybush 1976:190).

The other main type of quartzites would be metaquartzites which are, "metamorphosed sandstone, where heat and pressure have restructured sedimentary sandstone such that original grain size, shape, and other characteristics are obliterated.…[and it] form[s] through the metamorphosis of either orthquartzites or chert protoliths" (Pitblado et al. 2007:15). The toolstone used to make Embarras Bipoints and which appears to make up a significant proportion of the quartzite within my study area, would be metaquartzite. The metamorphosis resulted in coarse to fine-grained to almost chert-like quartzites.

Other properties that define quartzite would include "hardness, conchoidal fracture, and (usually) vitreous luster" (Howard 2005:708). Quartzite on the Moh's scale of hardness is approximately seven to seven and a half out of ten. This toolstone will break by concoidal fracture and it is anisotrophic, meaning there can be bedding plains (Bonnichsen 1977:83, 94). This implies that quartzite can be flaked in any direction but the fracture mechanics will be slightly variable from different angles and/or directions. This is different than other knappable toolstones, which are isotropic, where the fracture mechanics are the same in all directions and angles. Lastly, according to Howard (2005), the range in lustre is usually from dull to sparkly.

Characteristics of quartzite that are not included in Howard's field definition of quartzite would include texture, feel, colour and cortex. The texture of quartzite can be quite varied from phaneritic to aphanitic (or coarse to fine-grained), with most grains not being distinguishable to the naked eye. A fresh surface will look and sometimes feel gritty but higher quality quartzite will be smoother. The monochromatic range in colour is extensive including greys, whites, blacks, tans, yellows, reds, browns, blues, greens, and purples. Being metamorphosed sandstone, banding can be seen in some quartzites with all of the above colours combined. One could also look at colour for sourcing purposes (using the Munsell colour chart) (Pitblado et al. 2007). Some cortex will simply be the toolstone worn smooth over time. Yet, some cortex can be very distinctive and provide some useful insight about the interior stone. Natural transforms can produce impact scars or percussion marks on the cortex which are partial Hertzian or incipient cones. This usually occurs as a quartzite cobble impacts other rocks in a high velocity environment. According to Johnson (1998:30) percussion scarring and smooth cortex may be characteristics that can be used to identify specific types of quartzite.

4.12. Physio-chemical Make Up of Quartzite

What is quartzite made of? The primary component of quartzite is silica, SiO_2, in some cases the silica content can be as high as 98% (Johnson 1998:30). There are a wide variety of trace elements that can be found in quartzite. Johnson (1998:30) found minor elements of F, Ti, Al, Fe, Na, Ca, Mg, K and Ba. Another study found there are, "62 trace constituents in [....] quartzites—a figure that constitutes 69% of all naturally occurring elements" (Pitblado et al. 2007:28), which is an encouraging result for future attempts at sourcing quartzite. As a matter of fact, “quartzites contain[....] enough trace element variability to determine which formation they originated from” (Pitblado et al. 2007 :16).

4.13. Distribution of Quartzite

SiO_2 is one of the most common elemental combinations and since quartzite can have up to 98 % silica this means it, too, is a very common material. People in the past recognized the knappability of quartzite and used this toolstone for a very long time. In fact, “quartzite constitutes one of the most widely used aboriginal lithic materials, its exploitation extending across Africa, Europe, Asia, and North and South America, and spanning time from the Oldowan pebble tool industry of two and a half (2.5) million years ago, to its use in historic times” (Ebright 1987:29). Along the Eastern Slopes, more specifically in the Hinton-Jasper area, quartzite was used throughout Precontact times. At FfQh-26, a Goshen style projectile point was made from a fine-grained quartzite (Meyer et al. 2007:75, 2742).

Where was quartzite being collected? It appears that quartzite was obtained not from specific locations but from regions or locales. In the Hinton region there are a number of locales where one can fairly consistently collect high quality quartzite, (Figure 4.4). This does not imply that high quality quartzite cannot be collected outside of these locales, only that the chances are higher in certain places. As I have had the opportunity to work in this area for a number of years, and with my proclivity for making stone tools, I have been able to locate a number of locales with high quality quartzite.

McPherson Creek, a watercourse that runs past Hinton to the southeast and drains into the McLeod River, is one area with a high proportion of good quality quartzite. Also, McCullough (1982:56-57) notes that, “the Entrance Conglomerate consists of pebbles of quartzite and chert. [….] This outcrop could well have seen use as a quarry and the presence of prehistoric sites in the study area could be related to excursions into the McPherson Creek Valley to procure lithics”.

The exposed surfaces along the Lovett River, where FgQf-16 is located, are caused by modern forestry and oil and gas activities which have exposed large amounts

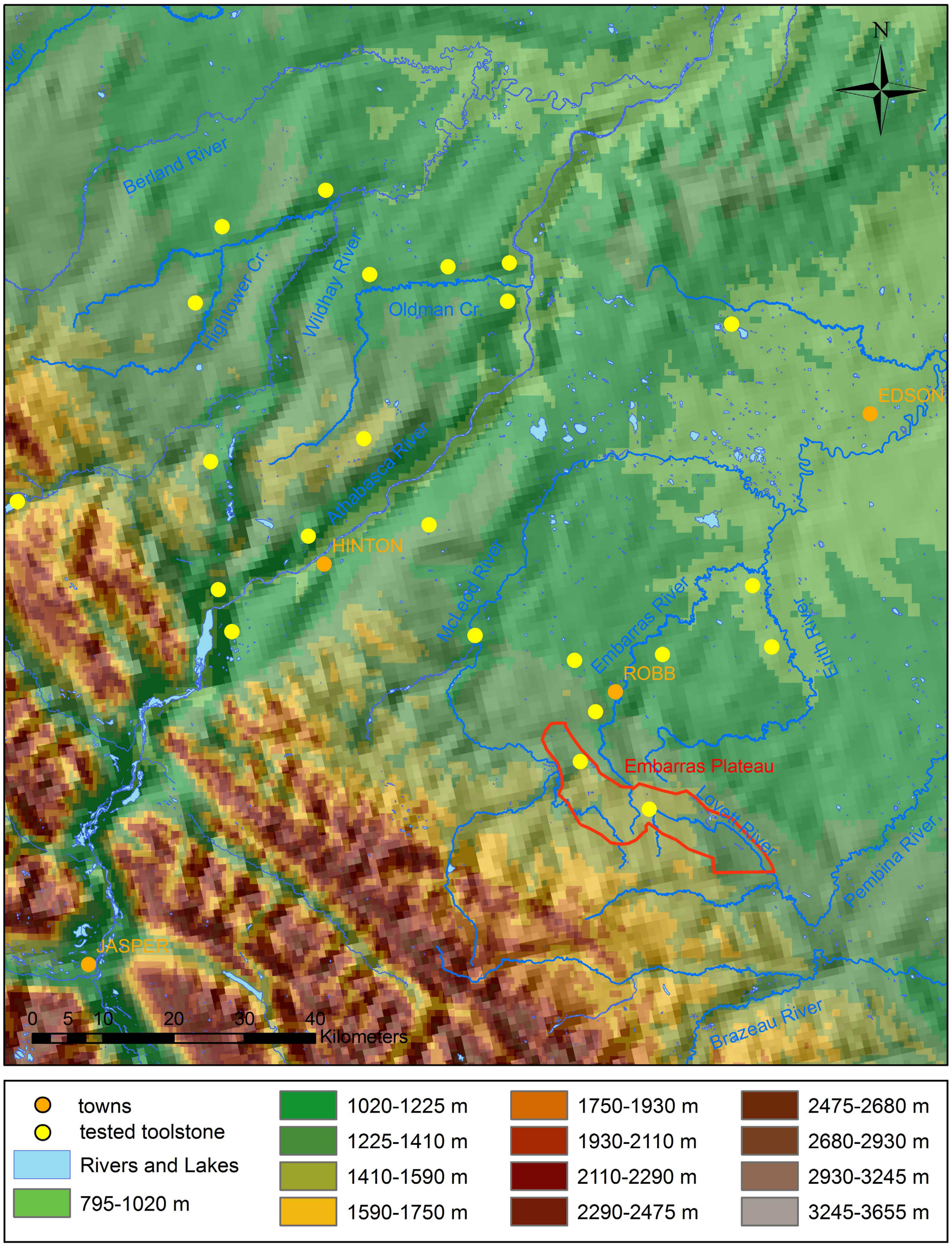

Figure 4.4: Locations in Study Area with High Quality Quartzite

of varying grades of quartzite. As a matter of fact, the entire Embarras Plateau area has an abundance of good quality quartzite, which might be one of the reasons why there are so many archaeological sites in this area (Meyer and Roe 2006:184). For example, FgQf-62, a site close to the Embarras Plateau, has been interpreted as, "an attractive small quarry source for local quartzites" (Meyer et al. 2002:74)

Another area to the east of the hamlet of Robb along McNeil Creek in the Edson Lowlands has good quality quartzite. The area north of Hinton along Hightower Creek, which drains into Pinto Creek, has good quality quartzite exposed in road cuts, harvested blocks and down cut creeks. Quartzite could also be coming from the Entrance Conglomerate (Alberta Society of Petroleum Geologists 1960). Entrance Conglomerate has been described as, "pebbles of quartzite and chert averaging one to two inches in diameter, with diameters as large as six inches" (McCullough 1982:57). These are only a selection of areas where quartzite could have been collected to make Embarras Bipoints.

Another area with both an abundance of high quality quartzite and archaeological sites with Embarras Bipoints is the Oldman Creek area. According to Meyer (2004:197), "This location served as a quarry and workshop area for local parties obviously making relatively heavy use of the Oldman drainage in Precontact periods. Here they could find abundant high quality quartzite cobbles, and the occasional silicified siltstone or chert nodules from which to create stone tools".

4.14. Quarrying Quartzite

Understanding the very beginning of a chaîne opératoire is absolutely necessary in order to better understand the later sequence of events a specimen goes through to become an artifact. The quarrying of quartzite is an essential step in the production of Embarras Bipoints. The choice(s) of quartzite blanks that have very specific morphological parameters was key to maximizing the results (i.e. finished tools) with the minimum amount of effort (i.e. the reduction sequence). Understanding how a toolstone is chosen and under what conditions those choices are made brings us one step closer to understanding the people that made Embarras Bipoints.

The first step is to define a quarry. This will be followed by a discussion of the three quarry types that would have been available and their similarities and differences. The quarries under discussion were sources of quartzite. Given this raw material, how did it affect, positively and negatively the choices that were made at a quarry.

What is a quarry? A simple definition would be a place on the landscape where a particular toolstone can be reliably collected. A small selection of quartzite quarries in western North America would include Windy Ridge Quartzite (Colorado), Spanish Diggings Quartzite (Wyoming), Hixton Quartzite (Wisconsin), Muddy Creek Quartzite (Wyoming), Tongue River Silicified Sandstone (Montana), Obed Till/Gravel Quartzite (Alberta), and Hinton Conglomerate Quartzite (Alberta). There are three main kinds of quarries: primary, secondary and the supermarket variety. Each type of quarry requires different collection practices and some would be considered short-term quarry sources and other long term.

4.14.1. Primary Quarry

A primary quarry is one where a specific toolstone is located in-situ as a bedrock formation and not found naturally in the surrounding area. One characteristic of a primary quarry is that the material has to be excavated from the ground. One location where there is strong evidence for this type of quarrying is the Windy Ridge Quarry, located in Colorado along the Continental Divide, with a minimum of 182 depressions, some up to 1.5 metres deep (Bamforth 2006:512). Windy Ridge quartzite is fine-grained and silver to grey in colour. Another example of a primary quarry can be found in central eastern Wyoming along Muddy Creek. This quarry is located 125 miles, or 201 km north of Cheyenne, near Badger, a station along the Cheyenne and Northern Railroad (Knight 1989:308). This quartzite is very fine-grained and ranges in colour from white through pink, dark red, to nearly black (Knight 1989:309). Supposedly, "Thousands, if not [.…] millions of tons" of material has been quarried from this locale (Knight 1989:310). Most primary quarries require a specific suite of tools to excavate the material from the ground. Usually a primary quarry is one to which people have returned over long periods of time.

4.14.2. Secondary Quarry

A secondary quarrying is intermedial to both a primary and supermarket quarry. This quarry category would be similar to a primary quarry except the toolstone is not in-situ or is found in a different location than the parent material. A secondary quarry is similar to a supermarket quarry, discussed next, in that the material is usually found in smaller amounts than in a primary quarry and may be spread out over a large area. One example of a secondary quarry is HhOv-112, north of Fort McMurray, near the Athabasca River. This location has a large amount of Beaver River Silicified Sandstone which was redeposited as a result of the Glacial Lake Agassiz flood event (Saxberg and Reeves 2004:129, 132). As a result of the redeposition, the toolstone can be found in a variety of forms from cobbles and boulders to large tabular pieces and lens deposits. This means a variety of different tools and techniques are required to extract knappable toolstone. Since the materials can be found in relatively large amounts, these types of quarries could have been used for long periods of time before good lithic material was exhausted.

4.14.3. Supermarket Quarry

The last type of quarry, proposed by Deavers (1988), is a supermarket quarry. The premise of supermarket quarrying is that an individual or group would go to an area with exposed glacial till, such as a river cut or blow-out, and then selectively choose the most desirable toolstone from a variety of material. In the till would be an assortment of many different lithic materials, some knappable and others left untouched. Most of the lithic material would range from rounded pebbles to large worn boulders. Most of Alberta, including the foothills, was glaciated at some point and therefore has glacial till. One could make the argument that, even though there is mixing of different lithic materials, there could be regions of similar toolstones. The quartzite used to make Embarras Bipoints came from this type of quarry were high quality toolstone was from a region like the Embarras Plateau. Other examples of supermarket quarries could be the Hinton and Obed Conglomerates. Since the material is mostly in rounded form a relatively specific assortment of tools and techniques would be needed to manipulate these toolstones.

4.15. Heat Treatment of Quartzite

Throughout the ages many different people used the heat treatment or thermal alteration of stone to transform unknappable stone into knappable lithics. The overall goal of heat-treating is to take a stone that has a strong tensile strength, rigid elasticity, and a soft brittleness and transform it into a stone with a weaker tensile strength, but which is more elastic, and brittle.

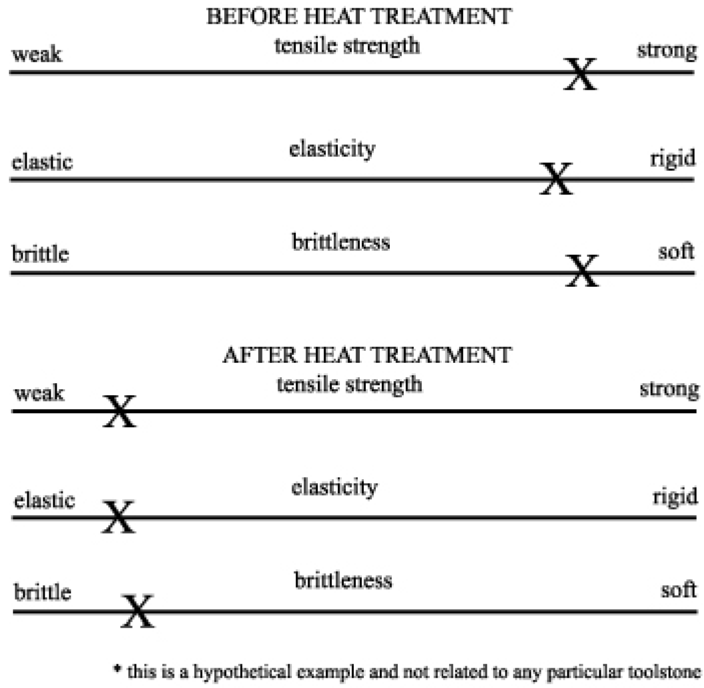

Figure 4.5: Generalized Results of Heat Treatment of Toolstone

Most quartzites already have all the criteria necessary to be knappable toolstones. I strongly believe quartzite was never heat-treated in the same fashion as other toolstone such as Swan River Chert or some Madison Formation Cherts. Quartzite, especially the metaquartzites from the Hinton and Obed Conglomerates, are metamorphosed sandstones that have had all the necessary pressure and heat provided by Mother Nature. One study, done by Dawe (1984), experimented with the feasibility of heat-treating quartzite. In his study he took uncooked quartzite and subjecting them to different temperatures for varying periods of time. Dawe's results indicated, as expected, that *heat treatment does not improve the knappability of metaquartzites*. As a matter of fact, one of the results of heating quartzite is that the integrity of the stone is diminished, resulting in a sugary texture and dehydrated appearance, where the bonds between quartz particles are weakened (1984; personal experimentation). Clearly, thermal alteration has more detrimental affects on metaquartzites than positive, so was not used in the chaîne opératoire analysis of Embarras Bipoints.

4.16. The Economy of Stone

To better understand why quartzite was used so frequently to make Embarras Bipoints one has to understand the importance of the toolstone. The main tenant of the chaîne opératoire approach is the study of an object from a raw state to a finished product. As such I want to explore the raw state, quartzite, in more detail in order to understand the questions of how, and possibly even, why quartzite was used to make Embarras Bipoints. This is important because as Bamforth (2006:511) states, "Archaeologists often recognize a continuum of technological behaviour from the procurement of raw material, through tool manufacture, use and discard [....]. However, while there is an enormous literature on the later portions of this continuum, its beginning—raw material procurement—is often neglected". Quarrying is not easy work, requiring a significant amount of time and effort to successful obtain usable material and should not be taken lightly, or dismissed as purely subsistence/survival based, a point supported by Bamforth (2006), Burton (1984), and Binford (1986). The primary source for understanding the potential meaning of quartzite, or any toolstone, comes from Whittaker's (2004) *American Flintknappers: Stone Age Art in the Modern Age*, where he explores in some detail the modern economics of stone. In his book he talks about how modern flintknappers use stone as a medium through which status, prestige, community development, and economics are developed and maintained. From this discussion I hope to show that quartzite was specifically sought out and was not an alternative or lesser valued lithic material than other knappable materials that could be used to make Embarras Bipoints.

4.16.1. Value

One assumption about material procurement, or quarrying, is that the practice was, "a low-cost activity 'embedded' in overall mobility patterns, which in turn are driven by subsistence practices" (Bamforth 2006:512). This idea may have some merit, but when lithic tools have an integral role in the subsistence and existence of a people, the toolstone has to have both a value and a currency. The value of a stone lies in the fact that it is the medium through which stone tools can be made. More precisely, the stone allows it to be useful to meet an end and, therefore, is valued over other types of stone which do not have the appropriate fracture mechanics, physio-chemical properties, availability, and size. A stone that is not homogenous, isotropic or of the right hardness, (for example muscovite) has little to no value as a knappable toolstone. This value is intrinsic and not culturally determined. In other words a stone has a certain knapping value regardless of how it is interpreted by a flintknapper, either in the past or present. By extension, this value translates to all knappable stone regardless of it origin. Obsidian from Mexico has the same value as the quartzite available to the makers of Embarras Bipoints along the Foothills.

Interpreting the value has to be approached differently for each toolstone. The facture mechanics of obsidian, chert, or quartzite will be different for each type. In some cases the fracture mechanics of a particular type of toolstone can be different for each individual piece. The fracture mechanics of obsidian are seen as brittle/elastic, sharp, less forgiving when producing a flake than chert or flint. Flint is harder, more forgiving, and less sharp than obsidian. Quartzite is similar to cherts and flints, but with idiosyncrasies that make the material unique. The material is generally harder than flint, less likely to produce as sharp an edge as either flint or obsidian, and can be forgiving to a point where a person can repeatedly strike a platform ad nauseam with no resultant flake. The forgiveness of a stone is related to the capability to strike, using a particular energy load and angle of swing, a platform with no resulting fracture or only the initiation of a flake that does not terminate. However, quartzite is not impossible to work, will produce an edge that is more durable than obsidian, chert, or flint, and with some slight modifications to the striking platform can allow some forgiveness.

So, the value of quartzite can be appreciated because of several important characteristics. Quartzite is still very knappable even when compared to other toolstones. High quality quartzite is readily available in my study area, as well as in the other areas where Embarras Bipoints have been found. The most important value that quartzite has is that when worked properly it can produce tools which are more durable and long lasting than those of other materials.

4.16.2. Currency

The other economic aspect of quartzite is its currency. This is a debatable topic but wholly relevant to understanding why quartzite was used as a toolstone. There is no way to know for sure what currency quartzite had to the people making Embarras Bipoints. But we have to assume this toolstone did have currency or they would have used other knappable stones to make Embarras Bipoints. One way to elucidate the currency of quartzite is to create a set of characteristic that was most likely applicable to this material. But first, currency needs to be differentiated from value. A stone's currency are the qualities that a knapper uses to appreciate or depreciate the stone and these qualities or currency can be related to the stone's value or adjacent to those values. For example, if two stones are of equal value, the currency will determine which of the two stones will be chosen. The currency could be colour, texture, edge sharpness, durability, availability, or any factor that a flintknapper deems important. A stone's currency is the amalgamation of the stones value with aesthetic, functional and/or other cultural predilections. To fully appreciate the importance of the currency of stone would be a thesis of its own.

To demonstrate the relevance and appropriateness of currency as related to the use of quartzite, the following characteristics will be discussed. The elements of currency are knapping quality, availability, colour, durability, and technical mastery. Each of these characteristics represent a potential reason quartzite was chosen to make Embarras Bipoints. There are other characteristics that could be explored such as cultural preference, access to material, trade, mobility, and settlement patterns but these will be left for future consideration.

4.16.2.1 Knapping quality/Knappability

This can be a highly variable characteristic of currency and is dependent on both the toolstone and the skill sets of the flintknapper. A flintknapper can be working with the highest quality material but if the knapping skill level is not sufficient, then the quality of the stone becomes less importance. Conversely, if a knapper has the skills, then the quality of the toolstone will influence the type of tool that can be made. The higher the quality of the toolstone, the more likely it will be used to make a more formal tool type, like a projectile point. Quartzite is a peculiar material to knap. This toolstone has characteristics that make it of value to work but with a few exceptions. Any seasoned flintknapper will tell you that each type of toolstone requires a different reductive approach and the use of different techniques to work the stone successfully. Quartzite is no different. As mentioned earlier, to successfully detach a percussion flake with quartzite requires a platform with morphological attributes within a certain range of parameters. A great example, which will be discussed elsewhere, is the setting up of sturdy, semi-isolated, well ground platforms that in many cases result in flakes with edge bite platforms. This type of flake removal, in turn, leaves distinct negative flake scarring on the tool, resulting in sinuous lateral edges. The sinuous appearance of the lateral edges is one of the hallmarks of Embarras Bipoints. So, understanding the knappability of a toolstone leads to better interpreting the Precontact currency of a lithic material.

4.16.2.2 Availability

The more available a toolstone is, the greater the range of tool types and size of tools that can be produced. The less a toolstone is available, the greater the restriction on the techniques and actions that can be used in a chaîne opératoire. These restrictive techniques will be necessary in order to conserve the toolstone. Microblades and microblade technology are great examples of how the availability of knappable toolstone can influence stone tool technology. The availability of toolstone can also be a factor that influences the size of the tools being produced. A knapped tool will always be smaller than the original unworked piece. So, the larger the pieces in a raw state, the greater the opportunity to make larger stone tools. The size of quartzite cobbles available to Embarras Bipoint makers ranged from pebbles to boulders, with melon-sized cobble being very common. This could be one reason why Embarras Bipoints are relatively large stone tools.

4.16.2.3 Colour

There is a restricted range of colours that were selected by the makers of Embarras Bipoints. The two dominant colours were white and grey (both lighter and darker shades). Coincidentally, the best or highest quality quartzites typically found in this area are white and grey. This is an interesting coincidence because Howard (2005:711) in his article, *The Quartzite Problem Revisited*, states that, "medium- to high-grade metaquartzites are typically white or black", which includes the vast majority of known Embarras Bipoints. There is also very knappable black quartzite that can be found with the other high quality quartzite but, for some reason, was not used to make Embarras Bipoints. To a lesser extent pink, purple, green, and orange/tan high quality quartzites were used to make Embarras Bipoints and are available in the modern landscape. How a quartzite becomes coloured is dependent on the trace mineral content which can include hematite, biotite, chlorite, or the absence of any pigmenting agent (Howard 2005 :711). However, the choice of a particular colour would be influenced by a toolstone's currency.

One obvious question is: was colour selection a result of cultural determination or was it merely a coincidence that white and grey are more commonly characteristic of high quality quartzite? The following are a selection of examples from around the world that clearly show that colour did influence the type of toolstone used.

The native people employed at the Rancho Petaluma in California actively sought out obsidian (presumably black or red) to make stone tools that were used as, "symbolic currency linking the native people ensnared in the rancho system with those outside of its reach" (Silliman 2001:204). Colour in this instance would be emblemic of the outside groups and at this same time differentiated the native made and Spanish made tools used on the ranch. The Western Desert Aborigines of Australia placed different, "aesthetic value on cherty materials of different color and texture" (Gould et al. 1971:161). Another example from Australia comes from Rodney Harrison's discussion of skeuomorphic Kimberly points where, "stone sources [often primary quarries with specific coloured stone] were often sources of creative power as places associated with the actions of Dreaming beings and ancestors" (Tacon 1991, as quoted in Harrison 2003:326). A more local example, the Peigan, as told by Saukamappee to David Thompson, would often use black stone to make specific arrowheads, because of the significance of the colour black to the Peigan, before the introduction of metal projectile points (Pyszczyk 1999:167).

Recently I had the opportunity to participate in a traditional use study of the Coal Branch area west of the village of Robb. One of the First Nations groups I worked with are the Small Boy Camp of the Mountain Cree who reside near the head waters of the Cardinal River and Grave Flats. According to one Elder who participated in the study, a particular white rock (which was identified to me) was highly regarded because, "it was powerful" (personal communication, 2007). Another Elder and bundle holder from the Alexis First Nations, a Stoney group participating in the TUS, told me that a brown rock (identified to me) was tied directly to the origins of his people (personal communication, 2007). Even though these examples are from different parts of the world, colour does have currency and may have been important to the selection of toolstone to make Embarras Bipoints.

4.16.2.4. Durability

This is one of the most important and unique qualities of quartzite. As mentioned earlier, quartzite cannot produce flakes that are as sharp as obsidian and other high quality knapping stone. However, the edge produced on a quartzite flake is still sharp and the differences between an obsidian flake edge and a quartzite flake edge, at a functional level, is relatively minimal. The biggest difference that makes quartzite a better toolstone for many tasks is that the edge is far more durable and long lasting than is obsidian and most crytocrystaline materials. This means the edge of a quartzite flake is sharp and will remain so longer than the edges of flakes of most other materials. If the task is cutting, scraping, or any other repetitive action, a quartzite tool is more efficient and less time consuming to maintain.

4.16.2.5 Technical Mastery

To produce a well made stone tool requires a certain level of skill and understanding of both the toolstone and the reductive techniques that work best to competently produce that tool. The technical mastery needed to work quartzite may have been a source of pride or satisfaction to the makers of Embarras Bipoints. In the modern flintknapping world, a source of accomplishment, status, and personal pride comes from being able to work with technically challenging toolstones (Whittaker 2004:147-152). The challenge of working a raw piece of quartzite into a complete and often exquisitely made bipointed tool could have been an element of currency to the makers of Embarras Bipoints.

4.17. Concluding Remarks

In sum, this chapter has been an overview of the Embarras Bipoints that were used in this thesis and a discussion of a selection of possible Embarras Bipoints. This was done to establish a data set that could be used for reference and analytical purposes. The second half of the chapter was a discussion of the physical and chemical properties of quartzite, the characteristics of currency and the value of quartzite. This was done in support of the notion that quartzite was not a alternative toolstone to other material but was in fact sought after as a primary resource for the chaîne opératoire of Embarras Bipoints.

Chapter 5
Other Large Bifacially Worked Stone Tools

5.1. Introduction

In this chapter the goal will be to investigate other large bifacially flaked 'bipointed' stone tools that may or may not be similar to Embarras Bipoints. A selection of artifacts that have been found in the literature on the Early Middle Period, mostly from the Eastern Slopes and adjacent areas, will be discussed and as much information as possible will be provided on these tools. The idea will be to illuminate any similarities these tools may have to Embarras Bipoints but, more importantly, I will also discuss their differences. The criteria to be used will be based upon their temporal, technological, and geographical relationship to Embarras Bipoints. The purpose will not be to augment the data set of known Embarras Bipoints but rather to make the argument that Embarras Bipoints are unique temporally, technologically and geographically.

5.2. Bifacial Technology

For the vast majority of North American Prehistory various bifacial technologies were the primary method for producing, maintaining, and rejuvenating stone tools. There are numerous arguments explicating the positive and negative elements for the use of bifacial technology over other technological sequences. One positive argument, according to Binford (1979), is that bifacial technology produces tools that because of their form and reduction sequence can be curated. A curated tool is one that is made in advance of being used and is transported for later use. This is different from an expedient tool which is made, used, possibly rejuvenated, and discarded *in-situ*. There are numerous implications that can be drawn from a curate-able technology. For example, a curate-able tool implies planning, and planning means an investment in or connection to the landscape that provides resources. A curate-able tool would have certain criteria that needed to be met, such as durability, access to toolstone, and other aspects. Having a good understanding of the surrounding environment and the available resources are two examples of what is required to produce curate-able tools. The people making and using Embarras Bipoints clearly understood and incorporated a curate-able stone tool technology.

Another advantage of stone tools that can be curated was put forth by Kelly and Todd (1988), who believed bifacial technology was a more efficient technology because a serviceable tool could be made and repeatedly used. The working edge of a stone tool could be rejuvenated repeatedly, making the use-life under normalized conditions relatively long. An adjacent point to this argument would be the number of serviceable working edges that can be created during the rejuvenation process, thereby increasing the efficiency and use-life of a biface. For example, if a stone tool is 5 cm in width, 10 cm in length and 2 cm thick then there is the opportunity to obtain approximately 30-40 cm of extra cutting edges from one series of flake removals (if the flakes were 5 cm long, 5 cm wide and 0.5 cm thick). This does not include the recycled 40 cm that could be reused on the lateral edges of the tool or the number of serviceable flakes that would have been produced earlier or later in the act of reducing the tool.

So, bifaces are a curate-able tool, have an extensive use-life and yet they have other favourable qualities. Bifaces are generally made to be transportable from place to place, which is implicit to being curate-able but worth noting especially for nomadic peoples who used them. In many ways, bifaces conserve raw material which, in the case of Embarras Bipoints, may have been important. Very fine-grained quartzite is a common toolstone in my study area. However, solid fracture-free, very fine-grained quartzite is not so common. Lastly, most forms or shapes of bifaces are conducive to performing a multitude of tasks. Even if the overall shape ranges from rectangular to triangular through to ovate, a biface can cut, scrape, slice, gouge, drill, or be used in any number of actions. In sum, a biface is curate-able, has an extensive use-life, is transportable, conserves toolstone, and can perform a multitude of tasks. This clearly demonstrates why bifacial technology was so widespread and utilized through much of Precontact times across North America.

5.3. The Criteria Used in Selecting Comparable 'Bipoints'

The remaining portion of this chapter will look at some examples of large bifacial tools that occur adjacent to and in some cases within my study area. The purpose will be to establish a data set of large, predominantly bifacially worked, stone tools that can be compared to known

Embarras Bipoints. Three main questions were posed regarding these tools: (1) How do they relate or differ temporally with Embarras Bipoints, (2) do they have a similar or different technological scheme, (3) and lastly are they found in geographically or environmentally similar or different areas to where Embarras Bipoint have been recovered.

5.3.1. Temporal Similarity

All of the examples are from the early part of the Middle Period (ca. 7,500-4,500 B.P.) unless otherwise noted. A comparison of tools older or younger than this block of time may have been constructive and insightful, but to make the best argument for the uniqueness of Embarras Bipoints the examples were restricted to bifaces that are temporally equivalent. The dates connected with these specimens were obtained either by absolute dating techniques such as radiocarbon dating, or dated relatively by association with known projectile point types.

5.3.2. Technological Similarity

Another defining point drawn from the comparison of these examples will be to illustrate the technological similarities and differences between these bifaces and Embarras Bipoints. In a number of ways, this was a problematic undertaking. For example, the scope of this project was limited to artifacts available within the time period to do this project. Hands-on availability of all of the artifacts being discussed was beyond the scope of thesis. So, as a result, many of the observations must be made from artifact descriptions and photographs. Unfortunately there was very little written information on a number of these tools.

5.3.3. Geographical Similarity

One very good argument for many of these selected stone tools not being Embarras Bipoints is the vast distance from my study area that many of these specimens have been recovered. In some cases the distance is negligible, for others the distances exceed hundreds if not thousands of kilometres and therefore will be an irrefutable factor in differentiating them with Embarras Bipoints, but they are still good for comparative purposes. The core of my study area is the Eastern Slopes of Alberta and some of the adjacent Great Plains area. There is no reason why the geographical distribution of Embarras Bipoints extends past what I have defined in this thesis, see Figure 1.1. As a matter of fact, one could predict that the geographical distribution of Embarras Bipoints will extend well beyond my study area, especially and predominantly along major watercourse. But for the present, any specimen outside my study area, unless stated otherwise, should be seen as an example of a bipointed stone tool and not an Embarras Bipoint.

5.4. Comparison to other Bipointed Stone Tools

The specimens to be discussed here are from the Eastern Slopes, northern Plains and adjacent areas of western North America. Information on these bifacially worked stone tools was found during a literature review of the Early Middle Period. All relevant data that could be found on these bipointed tools will be presented and interpreted, (see Table A.4). The inclusion of these specimens is not an argument for or against their equi-genesis but more about illuminating what makes Embarras Bipoints unique.

5.4.1. British Columbia

The new *Projectile Point Sequences in Northwestern North America* book edited by Carlson and Magne (2008), has numerous examples of bipointed stone tools (Figure 5.1) but only a selection of them will be discussed. These specimens, although found at a great distance from my study, were included in these discussion because of the similarities in overall form to Embarras Bipoints. Fedje et al. (2008:21) discuss “Xil” projectile points found in Haida Gwaii as, “large, contracting-stemmed spearpoint[s].... [that are] relatively large foliate points, with contracting stems lacking significant edge grinding…. willow leaf-shaped in outline…. Bases range from pointed to narrow-rounded or squared.… [and], these might be classified as bipoints”. In describing the flaking pattern they (2008:21) state that, “very controlled bifacial thinning flakes define .... the stem and .... broader billet flaking of the blade.”.

They make no mention of any specific toolstone for Xil projectile points but they do state that, “with very few exceptions, all lithic technology (bifacial, unifacial, and prepared core) on Haida Gwaii is made on locally available raw materials. A wide variety of argillites, siliceous argillites and rhyolites are available…” (Fedje et al. 2008:31). The overall form, shape, and use of locally derived toolstone are traits similar to Embarras Bipoints.

Figure 5.1: Bipoint Example from British Columbia (Carlson 2008:67)

There are some obvious differences between Xil projectile points and Embarras Bipoints. The most noticeable difference is temporal. Xil points date to 8,800-8,700 years before present and, as a matter of fact, Fedje et al. (2008:27) state quite clearly that, "there is currently no evidence for biface technology in Haida Gwaii between 8,000 and 3000 BP". None of the Embarras Bipoints have been dated earlier than 7,500 years before present. Another difference, a technological difference, would be the use of pressure flaking and in several cases notching on the proximal end.

On a larger scale, in British Columbia, some of the tools of the Foliate Biface Tradition, also called the Old Cordilleran Culture or the Early Pebble Tool Tradition, can be compared to Embarras Bipoints. According to Carlson and Magne (2008:354) these tools can be described as, "hav[ing] served primarily as knives… The bifaces are mostly willow-leaf (narrow) with some laurel-leaf (broad) foliates… with a lower margin tapering to a pointed or slightly rounded base". The bifacial knives of the Foliate Biface Tradition, to which the Xil Projectile Point belongs, have been found in numerous areas along the west coast including Prince of Wales Island, Haida Gwaii, along the Bella Coola River, the Fraser River, the Columbia Plateau, and the Fraser Plateau (Carlson and Magne 2008:354). These tools were, "made from locally quarried, fair to good quality, metamorphosed siliceous siltstones and fine to medium grained basalts/dacites. Use of exotic silicates is, "very rare" (Rousseau 2008:229). McLaren and Smith (2008:44) also note other locally derived materials such as, "siliceous argillite, shale/argillite, rhyolite, varvite, …., wacke, tuff, chert, andesite and basaltic andesite". Technologically they were produced from, "large blade-like flake blanks using primarily direct freehand hard hammer percussion, with some pressure flaking being executed to finish and/or resharpen" (Rousseau 2008:228-29).

The arguments against a relationship between Xil points and Embarras Bipoints can be used for all the bifacial tools of the Foliate Biface Tradition. The time period of the Old Cordilleran bifaces is much too early, the 9,000-8,500 year range (Rousseau 2005:9), to be contemporaneous with Embarras Bipoints. The possibility exists that the Foliate Biface Tradition could be ancestral to Embarras Bipoints but will have to be left for future consideration. Also, the use of pressure flaking, edge grinding for hafting, and in some cases notching on the proximal portions does not fit with the technological scheme used for Embarras Bipoints.

5.4.2. Idaho

Another artifact type to be discussed comes from the Western Idaho Burial Complex of the Late Cascade Complex. A significant element of this Complex is the grave goods (Green et al. 1986). Included in these grave goods are bipointed stone tools (Figure 5.2) and large side-notched projectile points. At both the Braden site and the Rocky Canyon site, a number of bipointed projectile points were recovered (Pavesic 1985:64-65). These bipointed stone tools are not unique to these burials because they have also been found at the Midvale site, the Mesa Hill sites, and in surface collections identified as campsites and/or workshops throughout Idaho (Pavesic 1985:69, 74). However, the interesting feature of the burial finds is they are, "enlarged and out of proportion to counterparts recovered in non burial contexts" (Pavesic 1985:58). One example from the Intermountain Cultural Centre collection measures 18.9 cm in length, 10.8 cm in width, and 12 cm thick (Pavesic 1985:68). So, their overall shape and size could be used as one argument for their similarity to Embarras Bipoints.

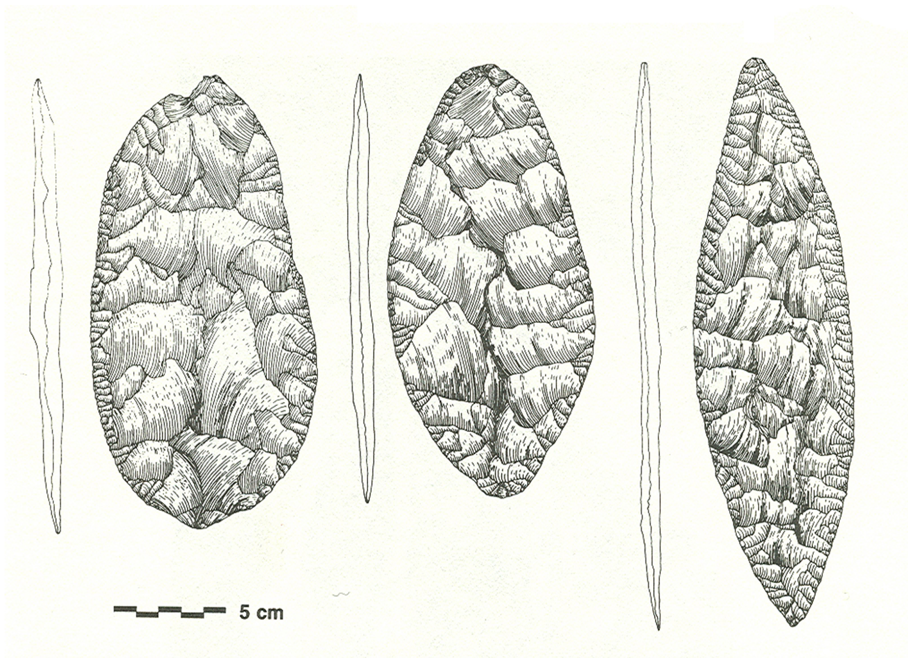

Figure 5.2: Bipoint Examples from Idaho (Pavesic 1985)

They are believed to represent finished forms and, "the quality of workmanship, the careful selection of materials and the size of the individual specimens are unique in the regional archaeology" (Pavesic 1985:68). These enlarged and out of proportion bifaces are made from, "high-quality siliceous stone and siltstone material [which] are believed to be of local origin" (Pavesic 1985:73). The reduction sequence used for the Idaho specimens has similarities to Embarras Bipoints. According to Pavesic (1985:70) these stone tools are thinned using soft hammer percussion. Muto (1971:90) in his discussion of materials from the Braden Burial site notes that, "the earliest stages show the same tendency toward unifaciality with the only scars on the ventral surface concentrated on the bulbar surface". This is one of the unique features of Embarras Bipoints production. The use of soft hammer percussion, local toolstone, their enlarged overall shape, and early stage unifacial reduction are all characteristics that are analogous to Embarras Bipoints.

Based on radiocarbon and obsidian hydration dating from the Braden site, the Midvale site and the Mesa Hill site, “the Western Idaho Burial Complex appears to date between 4,500 and 4,000 B.P. and possibly extends to 3,500 B.P.” (Muto 1971:78). These dates are towards the terminal time range for Embarras Bipoints. However, “several bipoint (Cascade-like) varieties have been recovered from the Midvale and Mesa Hill sites, where they are associated with side- and corner-notched points. Cascade points have a long history in the Plateau; they are reported in contexts dating from 9,800 to 4,500 B.P.” (Muto 1971:77). More precisely, “large side notched points (viz. Bitterroot, Northern, Cold Springs, Late Cascade) make their first regional appearance around the time of the Mt. Mazama eruption” (Muto 1971:76), which makes the Idaho materials more contemporaneous with the dates for Embarras Bipoints.

There are technological and toolstone traits that can be used to argue for similarities between Embarras Bipoints and Western Idaho Burial Complex materials. There are also temporal overlaps. One argument against these being similar is the great distance that separates the areas where these tools were used. Another would be that most Cascade bifaces are projectile points, not knives. Also, the Idaho Burial complex tools are “enlarged and out of proportion to counterparts recovered in non burial contexts” (Pavesic 1985:58), and apparently not as common as Embarras Bipoints are in the northern Foothills region.

5.4.3. Saskatchewan

The main focus of my research has been on archaeological sites in Alberta, more specifically sites along the Eastern Slopes of Alberta. However, after a cursory search of sites in Saskatchewan there is one example that can be used for comparison. The specimens come from one of the Chartier Sites, GlOc-20, in northwestern Saskatchewan.

In components three and four a total of five bipointed stone tools were recovered. These tools were made from quartz and fused sandstone which would be local toolstone, (for metric details see Table A.4.). They have been described as,

Figure 5.3: Bipoint Example from Saskatchewan (Millar 1983)

> basal fragments of end-blades… All are lanceolate in body form and are thickly biconvex in section. All appear symmetrical and are medium-large in size. None are ground and all converge proximally to a dull point… All are form flaked coarsely but trimmed by controlled flaking to produce the edge.
>
> (Millar 1983:143)

There are two very strong arguments for these not being Embarras Bipoints. Collectively they are half the overall size of the smallest known Embarras Bipoints (See Table A.4). For component two at GlOc-20 a single radiocarbon date was obtained of 1,275+/- 75 years before present (Millar 1983:57). These two variables make the five bipoints from GlOc-20 unlikely candidates for Embarras Bipoints.

5.4.4. Manitoba

There was only one example from Manitoba that could be used in this exercise, (See Table A.4 for metric details). The inclusion of a specimen that comes from such a great distance is more to illustrate the potential range that Embarras Bipoints could be found. This stone tool comes from the LM-8 site on Caribou Lake, (See Figure 5.4). This green quartzite bipointed tool has the requisite bipointed shape and size, is made from a locally derived toolstone, and is, "crudely fashioned by percussion flaking with some degree of retouching" (Buchner 1979:29).

This tool has been assigned to the Caribou Lake Complex which dates to between 7,000 B.C. and 3,000 B.C (Buchner 1979:79). However, the distance between my study area and Caribou Lake is almost too great and the time span, although with-in range, is too generalized to be temporally significant (Buchner 1979:29, 79, 157).

Figure 5.4: Bipoint Example from Manitoba (Buchner 1979)

5.4.5. North West Territories

There are a number of sites in the Northwest Territories that have produced large quartzite bipointed stone tools. The photographs and limited descriptions of these tools are reminiscent of Embarras Bipoints. The strongest argument against these tools being Embarras Bipoints would be the significant distance that separates the two areas. Conversely, the strongest argument for there being a technological, possibly cultural, connection would be the types of projectile points and radiocarbon associated with these stone tools. "Side-notched Kamut" projectile points with convex bases (Noble 1971: Fig. 2 g) and comparable ages of 6970 +/- 360 (I-3957) and 6850 +/- 150 radiocarbon years (GaK-3277, W.C. Noble, pers. comm. cited by Gordon 1976:48) were recovered from the Acasta Lake Site, southeast of Great Bear Lake.

Projectile points from Shield Archaic components along the northern border of the boreal forest and in the Barren Lands of north-central NWT are strongly reminiscent of Mount Albion Corner-notched points. Shared attributes include convex-bases, low side or corner notches, heavy basal and notch grinding, preferential use of quartzite at sites where cryptocrystaline rock types were also available, frequent asymmetry due to secondary use as hafted butchering tools, and evidence of wear along broken blade edges and the corners of tip fractures. According to Benedict and Olson (1978:168-69) the, "Shield Archaic materials from the Aberdeen (Wright 1972), Dot island (Wright 1972), Grant Lake (Wright 1976), and Migod (Gordon 1976) sites are representative, and would be unhesitatingly attributed to the Mount Albion Complex if found in the Colorado Front Range". The possibility that the Kamut point style was ancestral to the Mount Albion Corner-notched point is intriguing, due to a general resemblance between the two forms, but cannot be evaluated on the basis of the scanty published data.

5.4.6. *Alberta*

The vast majority of the tools looked at for this thesis come from archaeological sites in Alberta. The following descriptions are a selection of large, bifacially and unifacially made, quartzite tools that can be used to illustrate the uniqueness of Embarras Bipoints.

FhQf-89-15 (Table A.4)

This extremely large, grey quartzite biface was found while conducting a Historical Resource Impact Assessment of the West Fraser F.M.A. along the north side of McNeil Creek in a previously harvested cut block. This biface is 170 mm long, 120 mm wide, and 27 mm thick. This biface was found on the surface along with 14 quartzite and silicified siltstone flakes. This tool has an oval planview shape and a bi-convex transverse cross section. The flaking consists of large random, comedial, bifacial percussion flakes. The argument could be made that this artifact may have been a multi-directional core; however, the flaking appears to be more consistent with a bifacial tool than a core (Meyer and Roe 2006:542, 547).

For discussion sake, one could state that the toolstone used, the reduction techniques (i.e. percussion flaking although bifacial), and overall shape could be twinned to qualities found with Embarras Bipoints; however, the rarity of such a large biface makes any connection to Embarras Bipoints quite tenuous. Also, no diagnostic artifacts or dates were obtained for this site which means there could be a huge temporal difference between this artifact and Embarras Bipoints.

FhQe-18-59 (Table A.4)

This broken biface, made from pink and grey fine-grained quartzite, was recovered from the Hinton area. All of the main technological features that are associated with Embarras Bipoints are present except that the proximal end has been intentionally squared off rather than being made into a point. The distal end has an irregular snap fracture associated with internal flaws in the toolstone (Meyer et al. 2007: 549; Meyer et al. 2008: 510,519). In some cases the proximal and/or distal shape of Embarras Bipoints can be more rounded than pointed but a squared end is not an acceptable attribute.

FiQm-13-1 and FlQi-11-1, FhQf-10-1251, and FhQe-18-2 (Plate 24; Table A.4)

These four examples have been grouped together because of the close similarities between the specimens. In the future these artifacts may be classified as a new tool form that can be found in the Eastern Slopes, more specifically the Hinton area. A light grey, very fine-grained quartzite biface was recovered from FiQm-13. This bifacial knife tested positive for rabbit (Meyer et al. 2008). The tool has been described in this way:

> This complete Stage IV/V biface, made from grey fine-grained quartzite, has an asymmetric ovate shape and a bi-plano transverse cross-section. The distal end is rounded to a sharp and bifacially flaked. The lateral edges are slightly convex to straight converging

> towards the distal end. The body consists of large comedial percussion bifacial flaking with edge retouching producing straight sharp edges. The proximal lateral junctures are rounded. The proximal end is rounded with a slight unifacially produced concavity that appears to be intentional. One lateral edge has some edge rounding from approximately the medial axis towards the distal end. The overall appearance, the use-wear, and the width to thickness ratio indicate this biface may have been used as a hafted knife (Meyer et al 2008:517).

These tools are relatively large, have asymmetric excurvate lateral edges, are bifacially worked using percussion flaking, and have an oval planview shape. For example, the FlQi-11-1 (Plate 24) artifact has been described as,

> A complete Stage IV/V biface, made from light grey fine-grained quartzite, has an asymmetric ovate shape and an asymmetric bi-convex transverse cross-section. The distal end is squared and bifacially flaked. One lateral edge is excurvate while the other is straight. The body has a random, comedial bifacially percussed flaking pattern and a step stack on the one surface. The proximal lateral junctures are rounded and bifacially flaked. The proximal end is rounded, bifacially flaked with a unifacially produced concavity near one of the proximal lateral junctures. The excurvate lateral edge has rounding on the edge. The overall appearance of this possible knife, the rounding on the lateral edge, and the concavity on the proximal end bear a resemblance to artifact FiQm-13-1 (Meyer et al. 2008:517).

A complete Stage V biface (FhQf-10-1251: Plate 24), made from pink fine-grained quartzite, has a skewed ovate planview shape and a plano-convex transverse cross section. The distal end is pointed, bifacially flaked and skewed. The right, dorsal lateral edge is straight and the opposite edge is excurvate. The lateral edges are slightly sinuous. The proximal end is pointed to slightly rounded and bifacially flaked. The body has wide, random, comedial, bifacial, percussion flaking. The flaking pattern on this specimen is different from that of Embarras Bipoints and very similar to FiQm-13-1 and FlQi-11-1, and FhQe-18-2 (Hunt 1982:99).

The fourth bifacial knife (FhQe-18-2; Plate 24) has been described as follows:

> This complete Stage IV/V biface, made from grey fine-grained quartzite, has a bipointed overall shape and a plano-convex transverse cross-section. The distal end is sharp to slightly rounded and bifacially

> flaked. The lateral edges are straight to converging towards the distal end. The dorsal surface has been percussion flaked with edge flaking along the right lateral edge. The left, dorsal, lateral edge has extensive pressure flaking, that appears to be resharpening flakes, creating a steep angled edge. The ventral surface has wide, random percussion flaking with some edge flaking along the left lateral edge. The proximal portion has been slightly stemmed on the right, dorsal, lateral edge and there is a slightly concavity near the proximal end on the opposite side. The proximal portion is rounded. The right, dorsal, lateral edge and the stem on the same side are heavily rounded and the left, dorsal, lateral that appears resharpened indicate that this artifact may have been a hafted knife (Meyer et al. 2007:547-548).

A very unique feature of these four tools is that the proximal end has been modified, apparently for hafting purposes. The main technological differences between these tools and Embarras Bipoints are that the knives have a random, comedial bifacial flaking pattern. The proximal end is clearly modified so that the tools could be hafted with a handle or shaft whereas Embarras Bipoints were more likely hand held tools. No dates or other diagnostics are associated with these four bifacial knives, so there could be a temporal difference with Embarras Bipoints.

FgQe-14-2266 (Table A.4)

This specimen is a large broken quartzite biface. It has an ovate planview shape, with one straight edge, and a plano-convex longitudinal cross section. The dorsal surface exhibits large random, comedial, percussion flake scarring on the dorsal surface and edge flaking on the ventral. The medial edge has a burination fracture from the proximal to distal end along the longitudinal axis (Calder and Reeves 1977:14-15, 44). This artifact is similar to FhQf-10-974 (Hunt 1982) and FgQf-16-1009 and 1062 (Meyer and Roe n.d.). This specimen is different from most Embarras Bipoints because of the overall shape of the tool.

FgQf-16-1009 (Table A.4)

Meyer and Roe (n.d.) have described this artifacts as follows:

> This broken tool has an ovate, with one straight edge, planview shape and a plano-convex longitudinal cross section. A dark and light grey fine-grained quartzite was used for this tool. The distal end has been bifacially flaked and the edge has been ground or

> utilized. The lateral edge is excurvate. The proximal end has a burination fracture that initiated on the proximal end and terminated at the distal end. The dorsal surface has large, random, percussion flake scarring and the ventral surface has percussion edge flaking. The burination fracture appears to be associated with a crushed platform area and half a large percussion flake scar on the dorsal surface. This artifact is very similar in size, shape, and fracture pattern as Cat. #1062.

Similar artifacts were found at FhQf-10 (Hunt 1982) and FgQe-14 (Calder and Reeves 1977). The artifact differs from most Embarras Bipoints because of its overall shape.

FgQf-16-1062 (Table A.4)

> This broken biface, made of grey fine-grained quartzite has an ovate, with one straight edge, planview shape and a bi-convex longitudinal cross section. The distal end has been bifacially flaked and the edge has been ground or utilized. The lateral edge is excurvate with wide, random, comedial percussion flaking on the dorsal surface, and less intense wide, random, percussion flaking on the ventral surface. The proximal end has a burination fracture that initiates on the proximal end and terminates at the distal end. The burination fracture appears to be associated with a crushed striking platform on the proximal end. This size, shape, and fracture pattern of this artifact is very similar to Cat. #1009 (Meyer and Roe n.d.).

Similar artifacts were discovered at FhQf-10 (Hunt 1982) and FgQe-14 (Calder and Reeves 1977). This specimen is not an Embarras Bipoint for the same reason as FgQ6-16-1009, even though both of these artifacts have been recovered from an archaeological site with Embarras Bipoints.

FgQf-67-118 and 119 (Table A.4)

These are two different grey quartzite biface fragments that are clearly from two different, large bifacially worked stone tools. The flaking pattern consists primarily of large, wide, random soft hammer percussion flaking on both the dorsal and ventral surfaces (Meyer et al. 2002:183, 190-191). This flaking pattern and the overall shape of these broken tools are not convincingly like Embarras Bipoints.

FkQl-22-21 (Table A.4)

This artifact, made from grey fine-grained quartzite, is a biface fragment with snap fractures on the two medial edges. The snap fractures could be related to an error in the manufacturing process. The flaking consists of large, wide, random, bifacial, percussion flake scars (Meyer et al. 2008:510, 519). The flaking pattern and the lateral edge shape are not consistent with known Embarras Bipoints.

FhQe-21-1 (Table A.4)

This artifact is a grey quartzite biface fragment that was found on the surface. The flake pattern consists of large, wide, random, bifacial, soft hammer percussion flaking (Meyer et al. 2008:510, 519). This piece is too small to positively identify as an Embarras Bipoint or any other known type for this region.

FhQf-10-927 (Plate 23; Table A.4)

This artifact is a large white, with yellow banding, quartzite biface portion. This very well made specimen has a wide, random, comedial, bifacial, percussion flaking pattern. It was found in association with Embarras Bipoints, Lovett Unifaces, and Reverse Unifaces. The points at this site are predominantly dated to the Early Middle Period (Hunt 1982:93-95). The overall shape and flaking pattern are not compatible with the average shape and flaking pattern of other Embarras Bipoints.

FhQf-10-974 (Plate 23; Table A.4)

This large broken biface is very similar to artifacts FgQf-16-1009 and 1062 (Meyer and Roe n.d.). It has an ovate planview shape, with one straight edge, and a plano-convex longitudinal cross section. Wide, bifacial, percussion edge flakes have been removed from the body. The medial edge has a burination fracture along the longitudinal axis from the proximal to distal end. This particular tool was found in association with Embarras Bipoints, Lovett Unifaces, Reverse Unifaces and projectile points that are predominantly Early Middle Period styles (Hunt 1982:93, 95).

FjQl-9-1 (Plate 23; Table A.4)

This is a large, exquisitely made, grey quartzite biface portion. The overall shape is rectangular and the biface is missing the distal end. Given the size of this tool, it is extremely well made. The break on the distal end is associated with a texture change or internal flaw in the toolstone. There are also a series of step stacks associated with the break on the medial edge. The combination of the break on the distal end, use-wear on the lateral edges, and the step stack feature indicate that this tool was most likely used and resharpened before being discarded (Meyer 2004:455, 462). The overall size and shape of this specimen is inconsistent with known Embarras Bipoints.

FgQf-119-1 (Plate 23; Table A.4)

This is a large, very well made, grey fine-grained quartzite biface portion. The planview shape of this tool is cresentic to mostly ovate. There is a concave snap fracture on one lateral edge and the flake pattern consists of large, wide, random, bifacial, soft hammer percussion scarring. The proximal and distal ends are straight with obtuse angled lateral junctures. Interestingly, this specimen tested positive for canid (i.e. wolf, coyote or dog) (Meyer 2003:418,423). The overall shape and size differentiates this is specimen from Embarras Bipoints.

5.4.7. Bipoint Caches

Two caches of bipointed, bifacially worked stone tools have been reported. Very little information could be found on these cached tools and only poor quality photographs are available. The Morton Downey collection is a cache of bifaces, “enough to fill a windbreaker” (Wormington and Forbis 1965:180), found near North Star in the Peace Country area. From the photograph, these specimens are approximately 23 cm long and 7 cm wide, and appear to be similar in form to Embarras Bipoint (Wormington and Forbis 1965:180-81). The second cache is the Harold Matlock Collection of bipointed bifaces that appear to be similar in form and size to Embarras Bipoints and are made from what appears to be a local material other than quartzite. (Peace Past Project n.d.:37). Given the lack of data, these cached bifaces would require further examination before being classified as Embarras Bipoints.

5.5. Reverse Unifaces

Even though the focus of this chapter has been on large bifacial tools one would be remiss not to discuss Reverse Unifaces (See Figure 5.5), and some of the connections these tools have with Embarras Bipoints. The term, Reverse Uniface, was first introduced in 2004 (Kastaan 2004). These tools can be defined as large, predominantly quartzite spall tools that have been percussion flaked exclusively on the ventral surface and having a flat dorsal surface consisting almost entirely of cortex.

Figure 5.5: Examples of Reverse Unifaces from FgQf-16

The geographical distribution of Reverse Unifaces appears to be much larger than of Embarras Bipoints, with some being found in Saskatchewan and southeastern Alberta. A number of Reverse Unifaces and Embarras Bipoints have been recovered from the same sites, for example at FgQf-16 (Meyer and Roe 2006a, 2008a) and, FhQf-10 (Hunt 1982). A short compilation of other archaeological sites where they have been found include FkQl-15 (Meyer and Roe 2006:541, 551), FgQe-60 (Meyer 2003:419), FbNp-24 (Cyr 2006:120-121), and DjOn-26 (Vivian et al. 2008: 209, 213). For a more complete list of known Reverse Unifaces see Table A.4.

The fashion in which these tools were made is unique but has some technological similarities to Embarras Bipoints. Both are made from local materials. More specifically, all of the known Reverse Unifaces have been manufactured from quartzite. Reverse Unifaces have an exclusively unifacial reduction sequence where as Embarras Bipoints can be mostly unifacial.

However, there are several differences, other than the obvious reductive strategies, between Reverse Unifaces and Embarras Bipoints. Reverse Unifaces, based upon the overall shape and preliminary macroscopic use-wear, seem to be more restricted in the tasks they performed. One could predict, without the support of microscopic use-wear analysis, that Reverse Unifaces were used for woodworking or on some harder material. In contrast, Embarras Bipoints appear to be better suited to a wider range of tasks. One could also argue that Reverse Unifaces were more expedient tools because they have been found in greater numbers at campsite locations. For example, at the Gowen site in Saskatchewan Walker (1992:55-57, 83-85) identified 60 "gouges", that he now agrees are Reverse Unifaces (Ernest Walker 2007, personal communication). At FgQf-16, another campsite, a total of 21 Reverse Unifaces were recovered (Meyer and Roe n.d.). Lastly, at EgPn-624, a multi-component campsite, 4 Reverse Unifaces were recovered within a 5 m radius of each other (Vivian et al. 2008). The large number of complete and/or mostly complete specimens found at specific locations indicates they were most likely made, used, and discarded in the same place.

5.6. Erith Knives

A number of tools identified as Erith Knives (Figure 5.6) have been recovered from the Historical Resource Impact Assessment of Hinton Wood Products. These tools have been defined in this way:

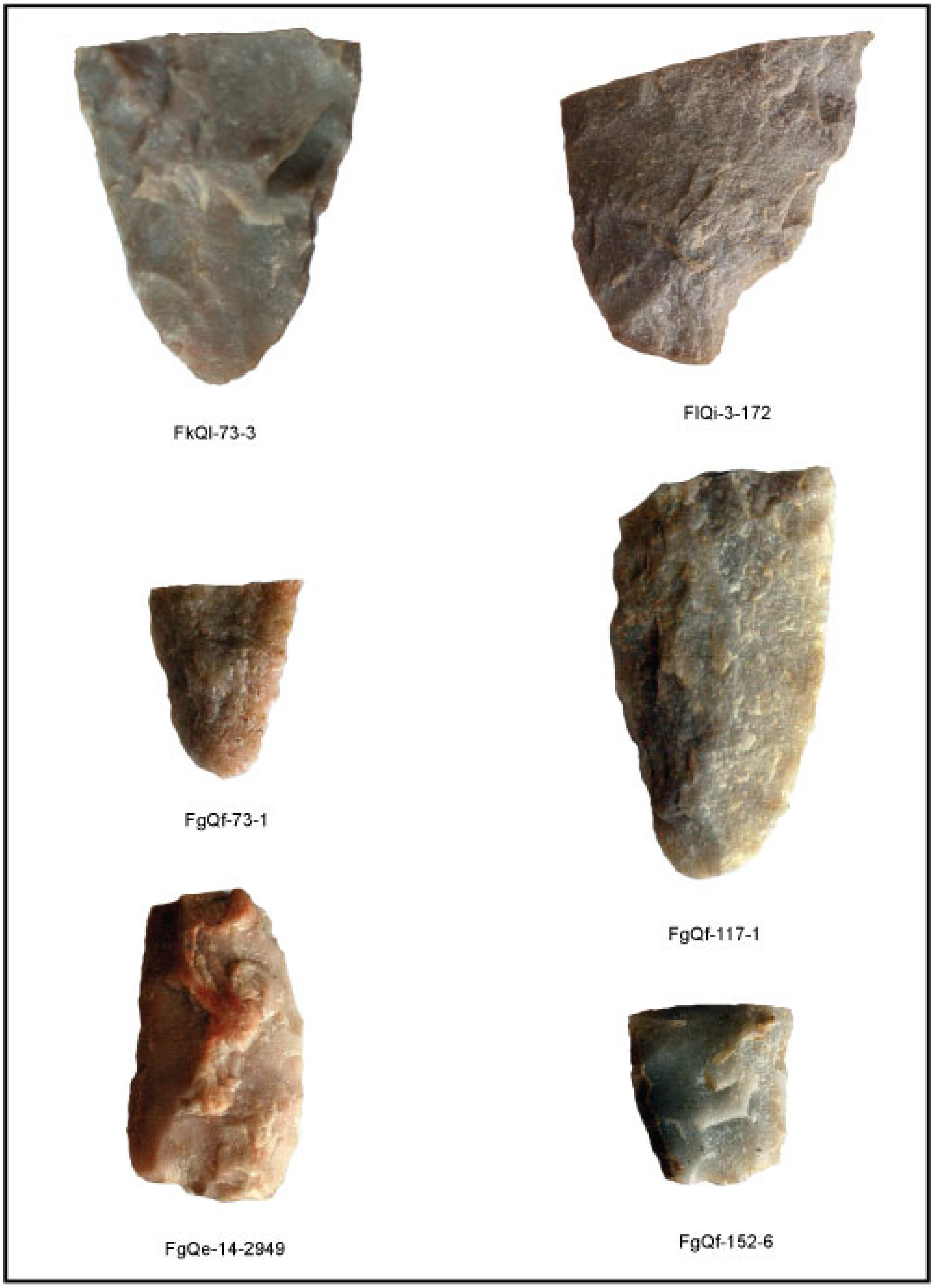

Figure 5.6: Examples of Erith Knives

> The edges of the item are straight to slightly convex, and both cross-sections are biconvex. Larger thinning flakes are sub-parallel, running from 1/3 to halfway across the face. Numerous small sharpening or use flakes are observed along both edges, but are considerably heavier along the 'straighter', ventral left edge suggesting this was the used edge of the knife… [The] length of the finished tool [is potentially, (this taken from a broken tool)] greater than 9 cm, a width of approximately 5 cm, and a thickness from 1-2 cm (Meyer 2003:198).

For metric information and a list of other known Erith Knives see Table A.4. The overall shape of these tools appears to be asymmetrically ovate to elliptical.

The geographical distribution of these tools appears to be confined to the Eastern Slopes of Alberta. However, an in-depth review of the archaeological literature may expand the geographical distribution of these tools. These tools appear to have been used as cutting tools-knives. The following examples provide a general synopsis of the technological and morphological attributes that are associated with Erith Knives.

FgQe-14-2949 (Plate 26; Table A.4)

This Erith Knife of light pink fine-grained quartzite is mostly complete. The overall shape is rhomboidal and it has a bi-convex longitudinal cross section. One lateral edge has been bifacially flaked and heavily ground, creating a straight edge and the other lateral edge is bifacially flaked and has an excurvate shape. The proximal end is skewed to the lateral edges, straight, and has been bifacially flaked (Calder and Reeves 1977:12, 43).

FgQf-16-1011 (Table A.4)

This stone knife portion, made from grey fine-grained quartzite, has a semi-elliptical planview shape and a plano-convex transverse cross section. The shortest exterior edge is mostly straight with obtuse angled lateral junctures. One lateral edge is excurvate and the other is straight. The body has large, random, percussion flaking on the dorsal surface and random percussion edge flaking on the ventral surface. The medial end has a snap fracture that may be related to a step stack along one lateral edge. This artifact is very similar in shape to FgQf-73-1 and FgQf-117-1 (Meyer 2003:417; Meyer and Roe n.d.).

FgQf-117-1 (Plate 26; Table A.4)

This exquisite, but broken, Erith Knife has been made from light grey, fine-grained quartzite. This specimen was used as the prototype to define the tool type (Meyer 2003). All of the defining characteristics of an Erith Knife are found on this artifact. Interestingly, this broken tool tested positive for caribou, evidence for its likely use as a knife (Meyer 2004:198, 417,423).

FgQf-152-6 (Plate 26; Table A.4)

This Erith Knife has been made from light grey quartzite. This broken tool has a plano-convex cross section and lateral edges that are straight, parallel to slightly converging towards the proximal end. The proximal end is straight to slightly convex. The dorsal surface has random, comedial, soft hammer percussion flaking and the ventral surface has edge flaking (Meyer 2004:455, 463). Although the flaking pattern is slightly different, the other morphological characteristics are typical for an Erith Knife.

FkQl-73-3 (Plate 26; Table A.4)

This broken Stage V biface portion made from grey, fine-grained quartzite has an isosceles triangle planview shape and a bi-convex transverse cross section. The distal end is rounded and bifacially flaked. The lateral edges are straight converging towards the exterior point. The body has a random, wide, comedial, soft hammer percussion flaking pattern. The medial edge has a snap fracture. The overall shape, material type and reductive technology are similar to other Erith Knives found in the region (Meyer et al. 2008).

FlQi-3-172 (Plate 26; Table A.4)

This broken Erith Knife has been made from grey, fine-grained quartzite and has a rounded, scalene triangular planview shape and a plano-convex transverse cross section. The medial end has a perverse fracture. The lateral edges are straight, converging towards the exterior end and wavy in cross section. The exterior end is obtuse angled, straight, and only flaked on the ventral side with cortex on the other. The body has a wide, random, bifacial, comedial, soft hammer percussion flaking pattern. This tool was found in association with an Embarras Bipoint (Meyer 2004:454, 455, 462, 466).

FgQf-73-1 (Plate 26; Table A.4)

This broken Erith Knife made of pink quartzite has a semi-elliptical planview shape and a bi-convex transverse cross section. The medial edge has a snap fracture. The lateral edges are straight and converge towards the excurvate exterior end. The body has a bifacial, comedial, soft hammer percussion flaking pattern. (Meyer et al. 2002:183,191; Meyer 2003:198, 417, 423). This particular artifact was one of the first Erith Knives found.

The similarities between Embarras Bipoints and Erith Knives include; (1) Erith Knives and Embarras Bipoints occur in the same assemblages and are of the same age, (2) they are made with quartzite, (3) they both appear to be hand held tools, (4) and there could be some overlap in the early stages of production between these tools. However, there is one important difference between the two tool types. The tertiary stages of production is significantly different for Erith Knives with the focus on creating an asymmetric primary working edge, a sharper less sinuous edge, and a different overall form.

5.7. Lovett Unifaces

Another new tool type identified from the work being done for Hinton Wood Products, as well as through a literature review of the archaeological sites in the Hinton area, are Lovett Unifaces (Figure 5.7). Lovett Unifaces have been defined as follows:

> The unifaces are all crafted from very thin, straight quartzite flakes resulting in plano-convex cross-section, edges are slightly convex to convex, and the finished form ranges from ovoid to sub-ovoid, to slightly pointed in some cases. The finished tool has been heavily worked on the dorsal surface to thin and sharpen the item. Flake scars run across the entire dorsal face and heavy retouch and in some cases use-wear is visible on this face as well. Although called unifaces, an occasional large flake has been removed from the otherwise flat ventral surface, most likely to remove small lumps, or perhaps even remnants of the bulb of percussion… Overall, Lovett Unifaces range from 5-8 cm in length, 4-6 cm in width, and all are less than 1 cm in thickness. The thinness of the items suggests that they were most likely used for functions such as cutting (Meyer 2003:199).

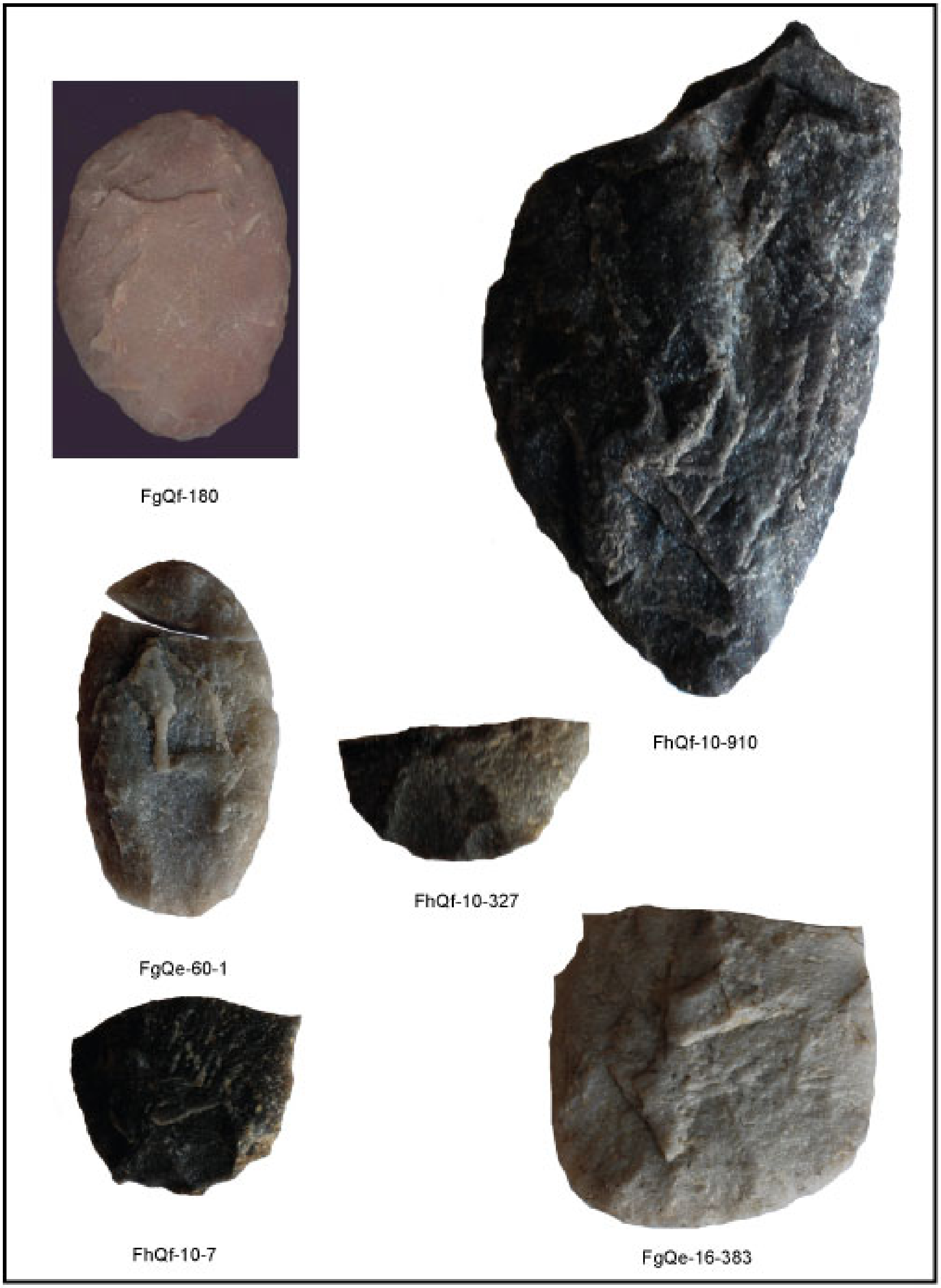

Figure 5.7: Archaeological Examples of Lovett Unifaces

For further metric information on Lovett Unifaces see the compilation of these tools in Table A.4.

The known geographical distribution of Lovett Unifaces is along the Eastern Slopes; however with further research this area may be expanded. As with Erith Knives, the Lovett Uniface appears to have been used as a hand held cutting tool, possibly as a knife. The descriptions below are provided as examples of the general morphological and technological traits of Erith Knives.

FgQe-16-383 (Plate 27; Table A.4)

This finely crafted, but broken, Lovett Uniface is made from white quartzite and has a rounded rectangular planview shape and a plano-convex transverse cross section. The medial edge has a snap fracture. The three exterior edges are straight with rounded lateral junctures. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern. The ventral surface exhibits light to moderate edge flake scarring. This specimen was found in association with Salmon River Side-Notched, Oxbow, and unnotched triangular points indicating an Early Middle Period Mummy Cave Complex occupation of the site (Calder and Reeves 1977:15, 44; Meyer 2003:199).

FgQe-60-1 (Plate 27; Table A.4)

This, refitted, complete Lovett Uniface, made from light grey fine-grained quartzite, has an oval planview shape and a plano-convex transverse cross section. The body has a random, comedial, soft hammer percussion flaking pattern. The ventral surface appears to be completely unmodified. This artifact was used to type Lovett Unifaces (Meyer 2003:416,425).

FhQf-10-327 (Plate 27; Table A.4)

This is a broken Lovett Uniface, made from dark grey quartzite, has a semi-discoidal planview shape and a plano-convex transverse cross section. The medial edge has a snap fracture and the exterior edge is strongly excurvate. The dorsal surface shows signs of wide, random, comedial, soft hammer percussion flaking. The ventral surface has been edge flaked (Hunt 1982:102).

FhQf-10-910 (Plate 27; Table A.4)

This is a mostly complete Lovett Uniface. This specimen is extremely well made out of purple, fine-grained quartzite. The shape is asymmetric ovate with one straight lateral edge and one excurvate lateral edge, and has a plano-convex transverse cross section. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern. The ventral surface appears to be unmodified. The excurvate lateral edge exhibits some use-wear rounding on the edge (Hunt 1982:104, 107).

Lovett Unifaces and Embarras Bipoints are similar in that: both are made from quartzite, and they may have overlapping actions in the early stages of production. Such similarities are not unexpected since they have been found together at several sites, they are hand held tools, and they both appear to be from the Early Middle Period. However, there are two obvious and significant differences between these tools: (1) the tertiary stages of production result in differently formed tools and (2) Lovett Unifaces are worked exclusively on the dorsal surface.

5.8. Concluding Remarks

The intent of this chapter has been to review an assortment of large, mostly bifacial, tools and compare them to Embarras Bipoints. The stone tools were selected based upon three main criteria: temporal, technological, and geographical. The specimens described in this chapter by no means exhausted the tools that could have been considered. Each of the tools were evaluated based upon the similarities they had with Embarras Bipoints and then these similarities were deconstructed to show the differences that make Embarras Bipoints unique.

Chapter 6

Experimentation and Replication of Embarras Bipoints

> If I would study any old lost art… I must make myself the artisan of it---must, by examining its products, learn both to see and to feel as much as may be the conditions under which they were produced and the needs they supplied or satisfied; then, rigidly adhering to those conditions and constrained by their resources along, as ignorantly and anxiously strive with my own hands to reproduce, not to imitate, those things as ever strove primitive man to produce them.
>
> (Cushing 1895:310, as quoted in Johnson 1978)

6.1. Introduction

Perhaps the best way to understand an archaeological object and how it played a part in the past is to replicate that object. Understanding its process of manufacture can lead to insights that may not be readily visible in the finished product. The first half of this chapter is concentrated on defining and explaining the experimental/replicative process. I will explore some of the positive elements of the process as well as some of the negative. I will discuss the experimental standards I have set and how they will influence the replication of Embarras Bipoints. This will be followed by a discussion of the various dynamic and static percussors that can be used in stone working. A general discussion and description of the better known flintknapping techniques that can be used will round off the first half of this chapter.

The second half of this chapter will outline the experimental process I used to produce replicas of Embarras Bipoint. Each stage of reduction will be discussed, starting with the primary stage experiments and ending with the tertiary.

6.2. Objective

The primary objective will be to replicate Embarras Bipoints. This will be done in a series of stages: early, medial, to tertiary. An adjunctive goal will be to build a chaîne opératoire that explicates the four elements of an action or series of actions as discussed in Chapter two and that can be interpreted in Chapter seven. Defining or interpreting the elements of an action will be done in a fashion that makes the most sense to me. Others looking at this data may form new opinions or even formulate different operational sequences based on their knowledge and/or purpose. I know, unquestionably, that this experiment is but a small part of what would be required to fully understand the manufacturing process of Embarras Bipoints and their role in the Early Middle Period. However, Crabtree believes, "the result of experimental work is usually a reduction of the number of ways in which [a] prehistoric object can be replicated" (Crabtree 1970:148), and following his lead I hope that I will be able to reduce the number of ways an Embarras Bipoint can be made.

6.3. My Credentials as a Flintknapper

To provide some credibility to the experimental work being done in this thesis: I have been an avid flintknapper for over a decade and in that time I have taken every opportunity I can to learn the art of flintknapping. New lithic material or tool types are seen as a challenge and as a result I have used a wide variety of flintknapping tools to make stone tools from a diversity of lithic materials. In preparation for this thesis I have been working with quartzite for the past couple of years to obtain a familiarity with this toolstone that will allow me to accomplish my replicative goals. Most importantly, as a modern flintknapper, I know my limitations and will be approaching the replication of Embarras Bipoints with the idea that I may not be using the most appropriate techniques and/or technology.

6.4. Defining Experimentation

Since Sven Nilsson, who as early as 1868 used replication as part of his lithic analysis, stone tool studies have come a long way (Johnson 1978:337). However, not until Donald Crabtree's seminal work starting in the 1960's was the foundation set for most of the knowledge we have today about replicating stone tools (Crabtree 1966, 1967a, 1967b, 1968, 1970, 1982). Regarding experimental replication, some archaeologists, "take a strict view that only a few kinds of experiments are useful, preferring to reserve the term 'replica' or 'replication' for experiments that conform as closely as possible to the archaeological evidence for manufacturing techniques, raw material, and waste products, as well as the form of the artifact" (Whittaker 2004:250). This philosophy was adhered to for all the experimental work done in this thesis. All of the techniques, flintknapping tools, and lithic materials should have been available to the peoples making Embarras Bipoints. In other words, I did not use foreign materials, such as copper, as part of my flintknapping toolkit because there was no archaeological evidence of the use of copper flintknapping tools in my study area.

There are a number of negative perspectives associated with using experimental replication to study stone tools. The most unconstructive viewpoint, to this thesis, is the idea that if a reduction sequence works then it must have been the only reduction sequence that could have been used. The replications done for this thesis are the exploration of one way to reproduce an Embarras Bipoint. There are numerous other experimental operational sequences that could have been explored in this thesis. So, regardless of whether one wishes to accept the results of these experiments I know other potential chaîne opératoires exist for the reproduction of Embarras Bipoints.

6.5. Experimental Standards

One constant standard throughout these replicative experiments is that only one person conducted all of the experiments. The exact input variables may vary but they should be within a range that is acceptable to produce relatively consistent results. Also, stone tools were not made by "stainless steel Indians" (Bonnichsen 1977:78). So, a human with human variables, not a machine or device, is the most appropriate approach to carry out a study of human made objects.

Another point to consider regarding this experiment is that, as Bonnichsen states, "it is a dangerous procedure to make inference from the output as to what the input variables were when evaluating a prehistoric specimen, unless one has control information available for interpretive purposes" (Bonnichsen 1977:182). The absolute control of all the variables, both mechanical and human, that influence the production of a stone tool are an unachievable goal. The control of, or at least the recognition of, as many variables as possible was an important factor in the creation and implementation of the experiments and analysis for this thesis. Thus, the expectation of a less than one hundred percent recovery of the experimental and/or archaeological data is not an outlandish expectation. For further discussion on the input and output variables that influence the production of a flake, or a stone tool, one is directed to Robson Bonnichsen's *Models for Deriving Cultural Information from Stone Tools* (1977). In this work Bonnichsen discusses the need for control over variables that influence experimental research and how constants need to be found.

6.6. Toolstone to be Used

In many ways, the makers of Embarras Bipoints made the choice of toolstone to use in the experiments an easy one. Embarras Bipoints were almost exclusively made from locally derived, high quality metaquartzite and, as such, all of the experiments were done with the same material. There are possible Embarras Bipoints made from other toolstone such as Glacier Silicified Mudstone, Banff Silicified Siltstone (possibly), and Nordegg Member Silicified Siltstone, but to maintain consistency these other toolstones were not used.

6.7. Tool Kit

This section has been divided into tools that were used and tools that were not used. To authenticate or justify the used of these tools, as many Precontact examples as possible will be provided.

6.7.1. Tools used

The antler tools used for these experiments were a collection of antler percussors and pressure flaking tools that were manufactured from moose and white tail deer sheds found within my study area (See Figure 6.1). Even with environmental changes through time, these antler types should have been available to the peoples making Embarras Bipoints. Each of the antler tools used has an archaeological equivalent, although not exclusively from the Early Middle Period: for example deer antler pressure flaking tools have been recovered from the FdPe-4 (Doll 1982:165), EgPn-506 (Vivian et al. 2003:202-03), Below Forks (Meyer 2002:21), and Sjovold sites (Dyck and Morlan 1995:131). At DjPp-8, which interestingly has been dated to the Early Middle Period (Reeves 1974:67), several examples of deer antler percussors were recovered. From the Early Period component at Blackwater Draw, a possible ivory billet was recovered (Stanford 1991:3). Some other organic options for percussors are elk, caribou, and mule deer antler, the tusks of ivory bearing animals, bison horn core, and a variety of large dense animal bones (i.e. calcanea and metapodials). However, for personal and legal reasons these materials were not used in these experiments.

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Figure 6.1: Antler Billets Used in the Experiment

The hammerstones used in these experiments were made from coarse-grained quartzite and highly cemented sandstone (See Figure 6.2). From my experience working with fine- grained quartzite, most other possible hammerstone materials are either too brittle, friable, or soft. The abrading tools were made from well-cemented sandstone. There are numerous examples of hard hammer percussors in the archaeological record; some examples would include the hammerstones and abraders from DjOn-26 (Vivian et al. 2008:45-47, 62-63, 68-71, 86-87,97-98,107-108), FgQf-16 (Meyer and Roe n.d.), FkQj-35 (Meyer and Roe 2006:543,560) and the Sibbald Creek Site (Gryba 1983:116). Archaeological examples of abraders have been found at the Stampede Site (Vivian et al. 2008), and the Sibbald Creek Site (Gryba 1983:114). Other potential toolstones for hammerstones and abraders include degraded granites, granites, argillites, limestones, semi-permineralized woods, gabbros, sandstones, mudstones, gneisses, and greywackes.

Figure 6.2: Hammerstones and Abraders Used in the Experiment

The anvil stone used is a 14 to 18 kg fine-grained quartzite boulder that was collected from the same area as most of the quartzite used in this experiment. It is spherical in shape and through previous use has a 10 cm divot that works well as a seat or rest. Examples of anvil stones in the archaeological record include specimens from DjPp-8 in the Crowsnest Pass (Reeves 1974:66), FgQf-61-24 (Meyer et al. 2002:73), there is a great example of an anvil at the Knife River Flint quarries in North Dakota (Ahler et al. 1983), and another at the Hartell Creek Site in Alberta (Murray et al. 1976:96). Many of the same materials that could have been used for hammerstones would have served very well for anvils.

The other tools used in this experiment include a 4.5 kg and a 6.8 kg iron sledgehammers. These were used in the initial stages of material acquisition. In preparation for this thesis, and to obtain the material being used in these experiments I needed to process a large amount of quartzite. The use of a sledgehammer minimized the time and effort needed to process such a large amount of quartzite. The sledgehammer definitely does not have an archaeological equivalent except, possibly, for large hafted grooved cobble mauls.

6.7.2. Tools not used

One percussor type that would have been very interesting to use is a wooden billets. There are a number of individuals, for example Jack Cresson from New Jersey (personal communication) who have done experimental and replicative work using wooden billets. For a number of reasons they are not being used in this study. One, I have very little experience using wooden billets. Two, in the modern landscape of my study area there are no tree species, except possibly for birch, hard enough to work as a percussor. One interesting study would be to subject a selection of wooden pieces to heat to see what fire-hardening properties could be obtained and how they would affect the wood as percussion tools. Also, if I were to broaden my area of study I could have used oak, apple, hickory, fruitwood, elm, persimmon, ironwood, semi-petrified wood, maple, mountain juniper, and dogwood.

The other material not used in these experiments was metal such as copper or soft iron. One reason was there are no archaeological examples of copper flintknapping tools anywhere near my study area. More importantly, copper does not have the best properties for working quartzite. Copper or other soft metals do not have the best kind of bite to produce quartzite flakes, so I favour moose and whitetail percussors.

The possibility exists that a flintknapping jig could have been used to make Embarras Bipoints, but the likelihood is relatively remote. One could imagine the use of a ‘Swoose’ jig because of its size, transportability and overall simplicity. A swoose jig is simple in design, using a forked branch, pressure and percussion to produce flakes. An interesting study would be the use of a flintknapping jig or, “stainless steel indian” (Bonnichsen 1977:78) to make Embarras Bipoints to see how such a contraption affects the manufacturing process. However, there are no archaeological examples from my study area that justify the use of such a tool.

6.8. Flintknapping Techniques

There are numerous ways to make a stone tool. This section will be a short discussion of the different techniques. The four techniques being discussed are hard and soft hammer percussion, pressure flaking, and indirect percussion. Each of these techniques will be defined and examples will be given on how each technique can be performed. Following the discussion of these four techniques I will introduce fire spalling and the possibility of other unknown flintknapping techniques which could have been used at various stages in the making of Embarras Bipoints. The techniques described here are both well documented ethnographically and employed by modern flintknappers around the world.

6.8.1. Hard Hammer Percussion

Hard Hammer Percussion is the oldest and simplest technique for producing a flake or stone tool. The use of one stone to fracture another is a technique used all around the world and it was used in the reduction scheme for making Embarras Bipoints. Speth (1974:9) very generally defines hard hammer percussion as,

> When a brittle elastic solid such as flint or glass [this would include quartzite] is struck by a hard hammer and the impact is of short duration, a compressive stress wave is produced which travels out from the point of impact with a spherically expanding front and at a very high velocity. [.…] In the immediate area of impact, a small conical crack, known as a Hertzian cone is formed. The cone penetrates only a short distance into the material, …. Relatively little happens beyond the impact area until the stress wave reaches the nearest free face of the core.

There are several different hard hammer techniques. The different sub-types include: direct ‘freehand’ percussion, body ‘supported’ percussion, bipolar percussion (core against anvil and oblique percussion), ground supported or hard rest percussion, and ‘monkey’ or throwing percussion (‘monkey’ being a colloquial term for throwing one stone against another). A variation of the ‘monkey’ or throwing technique would be burying a cobble that is too large to break using a hard rest. Then another stone is thrown against it in an attempt to break the buried cobble. Because the cobble is buried it is secure, minimizing rebounding, bruising and unsuccessful fracturing. Another benefit of this technique is that the large cobble to be broken will stay together in the ground, thereby saving unprotected shins and other body parts.

6.8.2. Soft Hammer Percussion

Soft hammer percussion is considered by some to be the hardest flintknapping technique to learn (Whittaker 1994:129). The makers of Embarras Bipoints used this technique and they did it well. Soft hammer percussion can be used right from the primary stages of reduction all the way through to the finishing stages of making a stone tool. Soft hammer percussion can be defined in much the same way as hard hammer percussion, with a few key differences. For instance, the swing angle to remove flakes is obtuse to the striking area. The different swing angle compensates for the much smaller striking edge allowing the Hertzian cone to initiate. The transfer of energy from the percussor to the piece being flaked is less dynamic (slower) and involves a larger impact point than does hard hammer percussion. The resultant flakes are generally wider and thinner than those produced by hard hammer percussion. Soft hammer percussion flakes also have a less pronounced bulb of percussion and compression rings. Lipping is far more common on soft hammer percussion flakes than those produced by hard hammer percussion. There are other more minor differences between hard hammer percussion and soft hammer percussion flakes.

Soft hammer percussion can be performed in three different ways. These sub-techniques include: leg secured, free hand, and anvil or hard rest percussion. Each of these soft hammer percussion techniques is self-explanatory. There may be other soft hammer techniques but they should be variations of the three mentioned here.

6.8.3. Pressure Flaking

The third technique for producing a flake is called pressure flaking. Crabtree (1970:151) defines pressure flaking as, "the [pressure] flaker is placed on the margin of the artifact and controlled pressure is applied inward in alignment with the proposed flake. As the pressing force increases, an outward force is imparted which causes the flake to detach from the artifact". Pressure flaking propagates flakes in a similar fashion to both hard and soft hammer percussion. This means the same fracture mechanics, for example the Hertzian cone principle, are in play. There are some fundamental differences, such as the static versus a dynamic transfer of energy. The static transfer of energy means there is no percussive energy exchange, making the resultant flakes very distinct from both hard and soft hammer percussion. There are a number of different sub-techniques of pressure flaking but most can be grouped into three main techniques the, ‘Crabtree style’, the, ‘Gryba style’ (E. Gryba 2006, personal communication), and/or the hard rest pressure flaking and shearing style. Obviously, any of these main categories of pressure flaking techniques could have been used to make Embarras Bipoints.

6.8.4. Indirect Percussion

The last major flintknapping technique to be discussed, which requires a high level of coordination and skill, is indirect percussion. This technique combines the accuracy of pressure flaking with the dynamic load transfer of percussion. Indirect percussion, “involves the use of an intermediate tool to transfer the force of the percussor… In use, the punch is positioned at the edge of a prepared platform and then struck with either a hammerstone or heavy billet” (Hellweg 1984:57). In other words, a blunt ended punch, usually made from antler or wood, is placed on the striking platform at an appropriate angle and then the opposite end of the punch is struck so that a flake is produced. Flakes produced by indirect percussion have the hallmark features of soft hammer percussion.

6.8.5. Fire Spalling

This technique may have been used to break up large cobbles of high quality quartzite. There are a number of sites in the West Fraser FMA, including FgQe-14 (Calder and Reeves 1977:31), FgQf-61 (Meyer et al. 2002:73), FgQf-90(See Figure 6.3), and FhQg-79 (Meyer et al. 2008), where this may have been occurring. Because there are archaeological examples within my study area that have what appear to be fire spalling features, this technique should be considered as a possible method for creating spalls that could then have been shaped into Embarras Bipoints.

One method of fire spalling is to build a fire that covers the cobbles for an even heating and leave the cobbles in the fire for a short period (15-20 minutes) so as to heat the stones and not chemically or physically alter them. When the cobbles are thoroughly heated they are either submerged or doused in water. The idea is to ‘shock’ not dehydrate the stone, an effective method for breaking up large cobbles into smaller spalls, flakes and shatter. This practice should not be confused with heat treatment where the intended goal is to thermally alter the stone by melting the particles in the stone to create a more homogeneous material or introduce micro fractures so that the stone becomes more flakeable. Plus, heat-treating is not required or recommended for quartzite (Dawe 1984; personal experience). Unfortunately, due to time restraints fire spalling was not used for this thesis.

Figure 6.3: Fire Spalling Feature at FgQf-90

6.8.6. Unknown techniques

Even though there have been numerous studies done on the different techniques that could have been used to make stone tools in the Precontact period, there is still much more work to be done. Cobb and Pope (1988:2) make this especially clear when they state, "there is the possibility of tremendous tool diversity based on the desired end-result, individual idiosyncrasies in knapping techniques, and the possibility that the choice of knapping tools was dictated in part by variable cultural traditions". The tools and techniques used for this thesis by no means exhaust the possible ways that Embarras Bipoints were made. Nevertheless, the flintknapping tools are readily available in the study area and the techniques, from personal experience working with quartzite and the results that could be obtained, have been proven to be very effective.

6.8.7. *Working Positions*

To do flintknapping for any period of time one has to have a comfortable working position. There have been a number of studies that have looked at the relationship between how a person placed their bodies when they make a stone tool and how this can influence the distribution of debitage (for example Newcomer and Sieveking 1980). As interesting as a study of this nature would be, it has to be left for future research. For all of the experiments, two different working positions were used. Most of the quarrying was done in a standing, squatting or kneeling position. This was because the size and nature of the cobbles being worked required a great deal of strength (standing using the throwing or 'monkey' technique) or the piece was large (bipolar percussion in a kneeling or squatting position). The second working position for all of the later stage work was a sitting position. There were a number of options that could have used such as standing, squatting and kneeling. Sitting in a chair rather than on the ground, squatting, kneeling, or standing was used because stone tools take time to manufacture and this was the most comfortable position. Sitting provides the sturdiest working position so that I can use my leg, which is planted firmly, as a working area. I am sure the makers of Embarras Bipoints had a number of working positions they could have used and I am absolutely sure none of them included a plastic folding chair from IKEA.

6.8.8. *Safety*

Safety was a primary concern before, during, and after the experiments for this thesis. To survive the nicks, cuts and bruises from making stone tools, as many safety precautions were taken as possible. These included eye protection, hand and leg protection, adequate rest, and fresh air.

6.8.9. *Broken Pieces*

When making stone tools the hope is that each replicative attempt ends with a complete tool. This is not always a reality and the piece being worked breaks prior to completion. What does one do with these 'failed' experimental attempts? One option would be to restart the experiment and ignore the results and products of the failed attempt(s). The approach used here was that everything, either broken or complete, was included. Unless there was some outside influence that could change the results, like dropping a completed Embarras Bipoint on a cement floor, then each experimental attempt had something to offer. Any failed attempts were considered finished and therefore considered to have a chaîne opératoire. Not all Embarras Bipoints from the past made it to a finished state either, so having a comparative example of 'failed' attempts was considered to be as useful as completed Embarras Bipoints.

6.9. The Experiment

I have divided the experiments into three stages. A number of the replicative attempts will be completed at the spall stage or at the medial preform stage. Even though they are not 'finished' they will be treated as complete for the purpose of these experiments. The reason for this is that many stone tools, in archaeological situations, are not started and completed in one location or time, which results in fragmented operational sequences. Having a more thorough understanding of these types of segmented replicative chaîne opératoires provides a better framework for dealing with the archaeological situations.

6.10. Primary Stage Experiments

All of the pieces collected for these experiments were successfully completed to this stage. The data from the study of the primary stage experimentation has been compiled into Table A.5. Each of the pieces were given an identification number (Figure 6.4) they were given randomly as the pieces were chosen for the experimentation. All of the cobbles are made from quartzite and the colours ranged from whites and greys, to greens, pink and blues. Column four describes the actions applied to each piece prior to the experiment. I decided to start with a variety of shapes and sizes to see if there would be any differences. Ultimately, each of the pieces originally started as a rounded cobble. Column five is a brief description of the cobble. The next three columns are general metrics showing length, width, and type of cross section. Column nine explains how much work would be needed to take each piece to medial preform stage. I did not fully expect each piece to make an Embarras Bipoint. As a matter of fact before the experimentation while collecting and identifying pieces for this experiment I noticed a number of pieces with major flaws. These pieces are just as valuable because problem solving was a major component of this experiment. The last column are comments that were relevant and not already on the table.

Figure 6.4: Examples of Cobbles Used in the Experiments

6.10.1. Objective

For the primary stage experiments the objective was to create as many spalls or large flakes as possible that could then be finished as Embarras Bipoints, using the previously discussed flintknapping techniques, similar to the artistic reconstruction seen in Figure 6.5. The spalls had to meet specific criteria based on the actual Embarras Bipoint form and shape as well as several preconceived ideas of what to expect. For example, the preform had to be larger than the finished piece. The type of cross section was also a consideration. To minimize the amount of work necessary to make an Embarras Bipoint, I believe that the people selected for a plano-convex cross section. So, any piece that could not be made plano-convex in cross section with the minimum amount of effort was discarded. These included pieces 2, 11, 12, 17, 22, 27, 28,

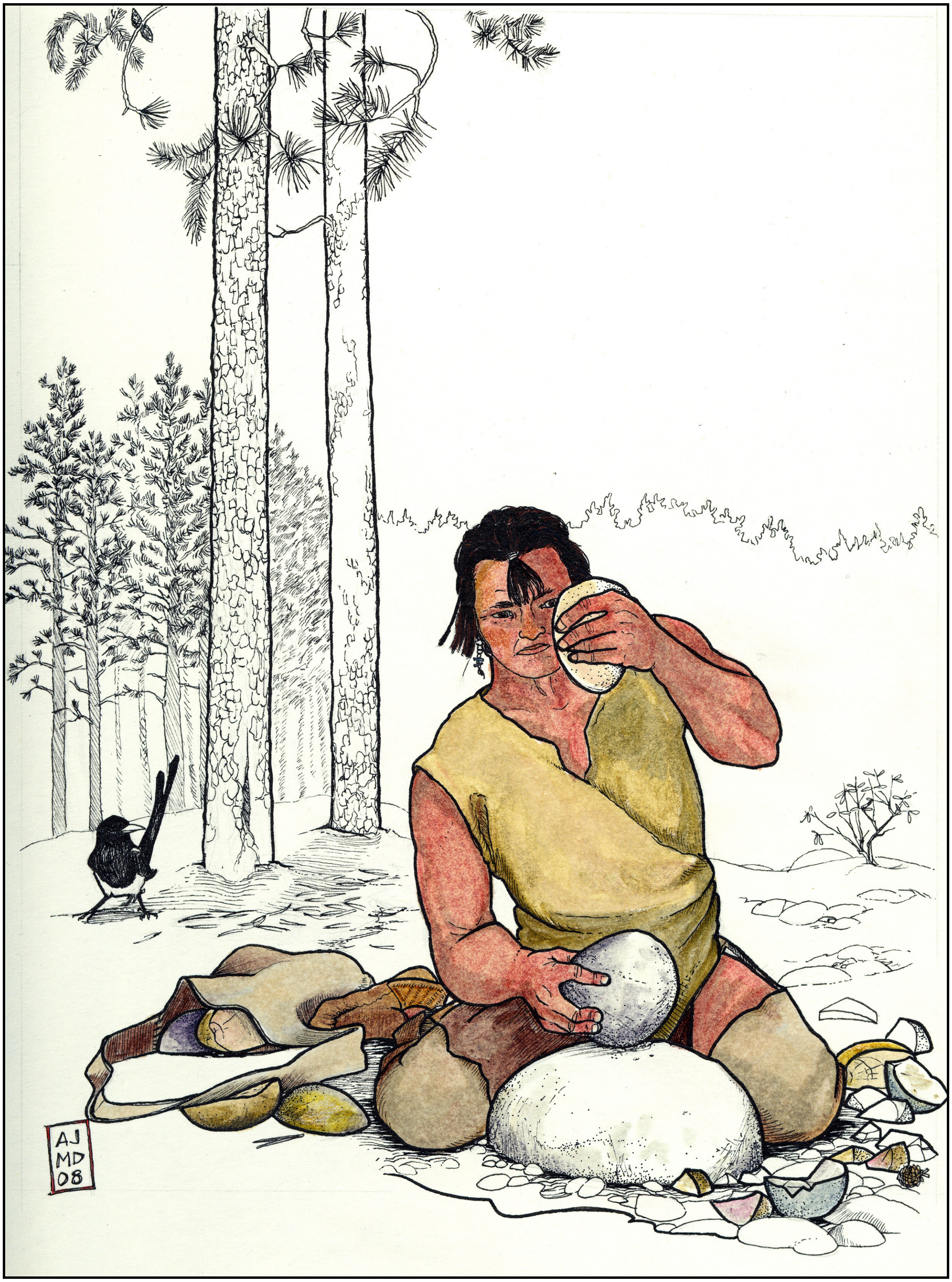

Figure 6.5: Artistic Reconstruction of Cobble Splitting (AJMD 2008)

36, and 40. Third, the experimental spalls had to be consistent with archaeological examples of spalls. This does not mean that the archaeological specimens are early stage spalls that would have been made into Embarras Bipoints rather they, predictably, appear to be what an early stage spall should look like. Also, all of the spalls were recovered from sites with Embarras Bipoints and therefore do not exclusively represent a chaîne opératoire from another time or tool type.

To assure the success of the primary stage experiments, pieces 5, 6, 8, 12, 14, 15, 18, 19, 23, 28, 30, and 31 were left unmodified because they already met the criteria needed to continue on to the medial stage experiments. The techniques used prior to these experiments included bipolar percussion, throwing/monkey percussion, and selection of natural spalls that met previously mentioned criteria. Because these techniques will be used in these experiments I felt excluding these prior actions would be acceptable. The remaining pieces, even if modified already, are the main source of data for the primary stage experiments.

6.10.2. Actions Taken

An action can be defined as any dynamic or static load transfer that results in a flake or spall that maximizes the amount of unwanted raw material removed from the piece being worked. In the case of the early stage experiments, an example of an action would be the downward swing of a hammerstone that contacts the core which in turn rebounds off of the anvil producing a spall. Included in any action will be all of the minor preparation actions that may be required to facilitate a successful action, such as platform preparation, edge grinding and so forth. The most repeated, and therefore successful, action in the early stage experiments was bipolar percussion, (see Table A.5). The reasons include: A familiarity with the technique provided a greater opportunity for me to observe more of the experiments. A greater amount of control can be maintained using bipolar percussion in comparison to the throwing technique. Most, if not all, of the collected cobbles were of a size that bipolar percussion made more sense than throwing. In other words, the only pieces where I used the throwing technique included those cobbles that I felt were too large for bipolar percussion.

The average number of actions needed to produce a workable spall was five, see Table A.5, which will be discussed in greater detail in Chapter seven. In the case of cobbles 7, 22, and 38 I needed to use more than twenty actions. Conversely, cobbles 1, 2, 14, 25, 29, and 40 needed one or two actions. In a less experimental situation, any cobble that required more than five actions would most likely have been discarded regardless of the results.

Only one cobble (#39) required the throwing technique. In only two actions I was able to produce one good spall and another that may be used. A number of the cobble and cobble spalls collected in the field were the results of the throwing technique. From that experience and the experiment, several observations can be made which will only be mentioned here and discussed further in the next chapter. The throwing technique can produce desirable results. Increased experience with the technique improves the ability to aim the cobble at the anvil and dramatically improves the outcome. Throwing does come with a number of safety issues that need to be considered. For example, when the cobble hits the anvil the whole cobble or the split spalls can rebound in any direction. Although not fatal, a bodily impact by any size of rock can be painful and may play a deciding factor in whether to use this technique. This being said, the technique does work and may in fact have been used to produce early stage spalls for the production of Embarras Bipoints.

6.10.3. Actions Not Taken

There are other techniques that could have been used in these experiments but for a number of reason where excluded. The first technique is free hand hard hammer percussion. This is where the cobble is held in one hand and a hammerstone in the other. The cobble is then hit with the hammerstone and a flake is produced. This was excluded because the size and the material of the cobbles being work would have required a physically much stronger person. This technique works very well when producing smaller spalls or when it involves using a less difficult material to fracture. This does not mean that free hand hard hammer percussion could not have been used or that the technique cannot be modified to produce desirable results.

The very first Embarras Bipoint I ever found was from FgQf-143. One of the unique characteristics of this particular tool was a strange lipped feature near one of the bipointed ends. My initial thought was that this was the remnant lip and striking platform of a large fan flake (Meyer 2003:202). This supposition was founded on the expectation that quartzite would fracture similarly to other knappable toolstones. Producing a similar sized spall using most cherts, flints, and other cryptocrystallines can be accomplished using a large moose billet and soft hammer percussion. However, on numerous occasions prior to these experiments I tried, very unsuccessfully, to produce large fan flakes out of quartzite exhibiting the morphological features that I believed should be present. The reasons this did not work were either the striking platform was too strong, or not strong enough, or the billet was too small. In order to produce a successful spall one would require a moose billet larger than even a fully mature bull could produce. One avenue to be explored, which has been discussed elsewhere in this thesis, would be the use of wooden billets made from hard wood. Jack Cresson, a flintknapper from the United States, has successfully conducted numerous informal replicative studies using hardwood billets on meta- and orthoquartzites (2000, personal communication). The one major problem is in my study area there is a lack of any hardwood trees that would be suitable.

Indirect percussion was not used for this stage of the experiments. I believe indirect percussion would have been unsuccessful for many of the same reasons that soft hammer percussion was not successful. The only foreseeable way that indirect percussion could have worked would be with the assistance of a jig. Such a jig would have to be either very large, very sturdy, or both, to a point where its mobility would have made the apparatus far more cumbersome than useful.

6.11. Medial Stage Experiments

6.11.1. Objective

The objective of the medial stage experiments was to produce replicas that mimicked the artifacts found in Table 7.2 in Chapter seven. The examples in this table represent what would be one of the logical connections between the archaeological examples in Table 7.1, also in Chapter seven, and finished Embarras Bipoints. Are they in fact examples of Embarras Bipoint preforms? Answering that question is beyond the scope of this thesis. However, to produce any tool out of stone it has to go through stages of reduction and all of the examples in Table 7.2 have a range of similarity that makes them likely candidates. Also, and most importantly, all of the examples in Table 7.2 were found at archaeological sites where Embarras Bipoints have been recovered. It is felt that this criteria, although somewhat nebulous, makes them more likely candidates than similar preform types from sites without Embarras Bipoints.

The reduction strategy was to focus the removal of the majority of the shaping and thinning flakes on the dorsal surface, and flaking the ventral surface only when necessary. In some cases, for example #5, 10, 13, 17, 27, 33, and 37, the reduction strategy had to be altered because of the overall shape of the piece. These examples did not have a plano-convex or bi-convex cross section. This meant the ventral surface had to be worked more than for the rest of the pieces. Even when the ventral surface had to be worked on these pieces, the goal was to do so in as few actions as possible in order to maintain the chaîne opératoire that the dorsal surface received the majority of the reduction actions.

6.11.2. Success Rate

A total of twenty-seven pieces were completed to this stage and thirteen pieces were not worked past the primary stage or failed when being worked to the medial stage, see Table A.6. This means just over two thirds (68%) of the spalls modified to the medial stage were successful, which is a higher success rate than expected. Finishing two out of three pieces to the medial stage, following the sequence of actions I believe was used, is a fairly decent result.

6.11.3. Actions Taken

The two most common techniques used to complete pieces to this stage were hard hammer percussion and soft hammer percussion. Hard hammer percussion was used for larger mass removal and platform preparation. Soft hammer percussion was used for longer, wider, thinning actions. On several occasions indirect percussion was used to remove stubborn flakes. As with the early stage experiments, an action included any and all striking platform preparation, edge grinding, and/or less obvious actions that facilitated the detachment of larger hard or soft hammer percussion flakes.

The assortment of hard hammers included a melon-sized coarse-grained quartzite cobble, a slightly larger than fist-sized coarse-grained quartzite cobble, and a plum-sized coarse-grained quartzite cobble. From personal experience, most other stone types would not have produced successful results because quartzite strongly resists fracturing. A coarse grained limestone abrader was used for platform preparation actions.

A large, dense moose billet with a rosette diameter of 5 cm was used for almost all of the soft hammer percussion. A smaller moose billet, 2.5 cm in diameter, was used when needed. Both the density and availability of moose antler versus other types of antler or wooden percussors made them the logical choice for the work done in the medial stage experiments.

All of the detritus produced during the experiments landed in a cardboard box and then was transferred to a 20-litre pail after each piece was worked. The expectation was that a lot of debitage would be produced in these experiments so, to minimize the amount of work, none of the debitage was kept. As a piece was being worked, any peculiarities or other interesting features seen on the debitage were recorded.

A notebook was kept close at hand to record any useful observations that were made during the experiments. The types of observations include the metric dimensions of a piece before being reduced, any observable obstructions that might interfere with the reduction of a piece, any predictions, and what did happen during the reduction of the piece.

All of the safety precautions discussed elsewhere were followed during the experiments. These included eye protection. A thick shoe leather pad with a folded heavy cotton pad underneath was used to protect my leg both from errant flakes and the repetitive impact of the billets and hammerstones. The work area was well lit and had a constant circulation of fresh air.

6.11.4. Actions Not Taken

Although tried, pressure flaking was not used because the pieces were too thick. To successfully pressure flake at this stage would have required either thinner pieces or more strength than I was able to provide.

Indirect percussion was used on several occasions during the medial stage experiments. As mentioned elsewhere in this thesis, the use of indirect percussion was not a priority technique because all of the actions could be performed using other techniques. The only case(s) when indirect percussion was useful was in the removal of stubborn flake terminations with snap fractures on the proximal end.

The use of bipolar or throwing percussion was not necessary at this stage so was not used.

6.12. Tertiary Stage Experiments

6.12.1. Objective

The goal of the late stage experiments was to take pieces that had been completed to the medial stage and complete them as finished Embarras Bipoints, similarly to Figure 6.6. A piece

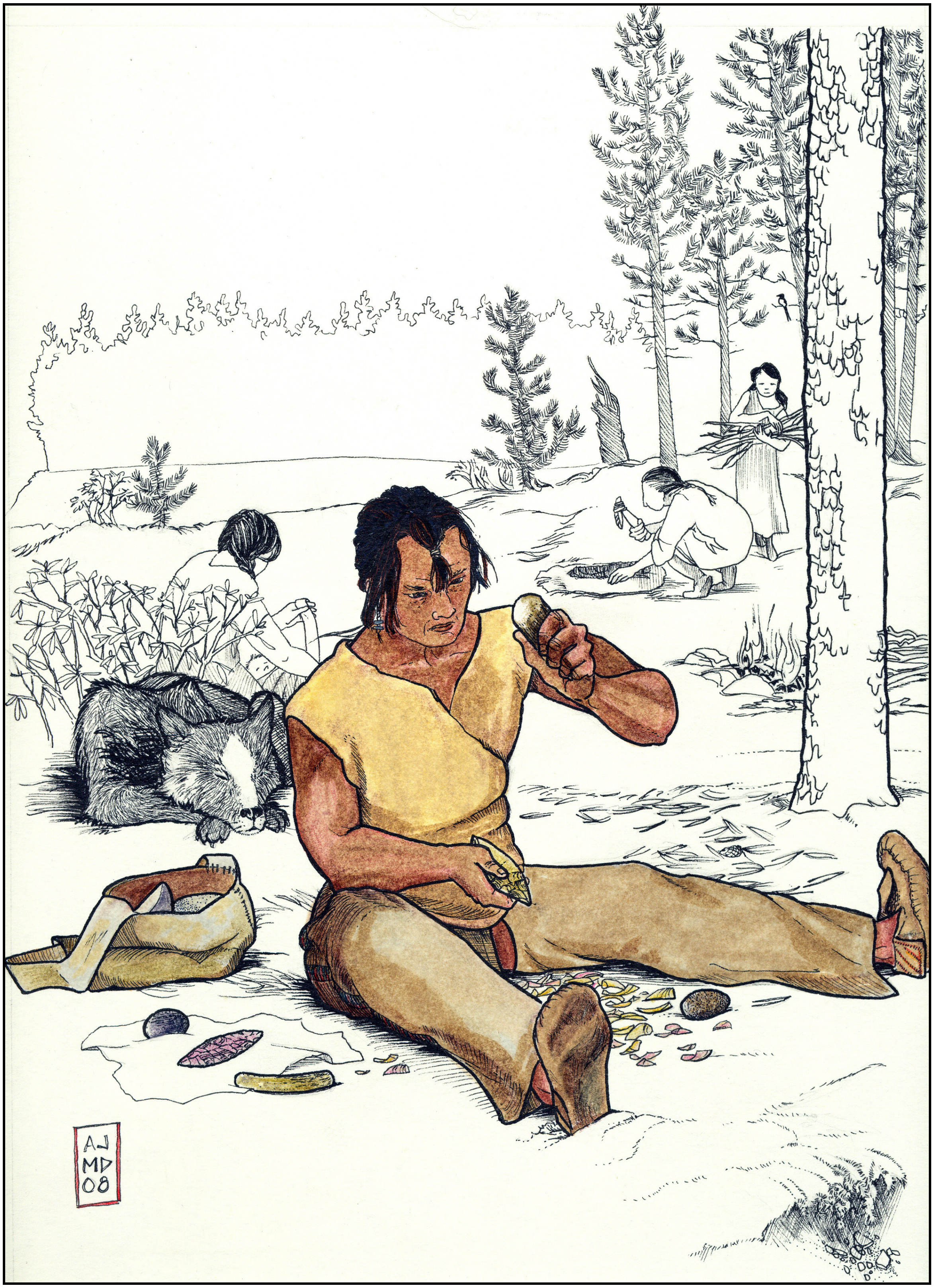

Figure 6.6: An Embarras Bipoint being Finished (AJMD 2008)

was considered finished when the average thickness was equal to or less than 1.5 cm, (See Table A.7), which was consistent with the archaeological examples of Embarras Bipoints. Secondary consideration was given to the length and width in that the piece had to be equal to or larger than the average Embarras Bipoint. The reduction strategy used for the tertiary stage experiments was similar to that employed for the medial stage in that the majority of the flaking was focused on the dorsal surface of the artifact. Flaking on the ventral surface consisted of bulb of percussion reduction, shaping, a minimal amount of thinning, and platform preparation flaking for the removal of flakes on the dorsal surface. The major difference between these experiments and the medial stage experiments was the attention given to appropriate platform preparation, overshoot and end shock trauma, and the shape of the piece in longitudinal cross section. For example, with the bulk of the flaking being done on the dorsal surface the lateral edges would have to be flaked on the ventral surface so that the edge would be below the longitudinal axis so that further flaking could occur.

6.12.2. Success Rate

A total of 18 pieces, out of the 40 original specimens, were finished to this stage (see Plates 28 to 30), in a similar fashion to that seen in Figure 6.6. Regardless of 22 pieces that were left incomplete or broken, overall the experiment was a success. Even the pieces that broke during the tertiary stage experiments had fracture patterns (discussed in Chapter seven) that were very informative.

6.12.3. Tools Used

The same soft hammer percussion billets were used for this stage of the experiments. With another toolstone, there may have been a need to switch to smaller percussors, but the weight and density of the two used were necessary to produce appropriate results.

The only hammerstone used was the peach-sized coarse-grained quartzite cobble. The density and weight were perfect for platform preparation flaking and some shaping and thinning. This same hammerstone doubled as an abrader because solid striking platforms were a necessity.

To clean or sharpen the lateral edges, there were occasions when pressure flaking was used. But, unless quartzite is very fined-grained, the success rate of pressure flaking is less than desirable. One could argue that with experience the use of pressure flaking could have been more useful. However, the results that were obtained without a lot of pressure flaking lead me to believe that this was a technique used sparingly. The pressure flakers consisted of a selection of Whitetail Deer tines of various sizes, ranging from two centimetres to pencil thick in diameter. Any pressure flaker maintenance was done with either the peach-sized sandstone hammerstone or a metal rasp.

All of the safety precautions used for the medial and primary stage experiments were also employed for the tertiary stage experiments. The one difference was a leather hand pad that was used to protect my hand when pressure flaking. Also, any interesting observations during the experiments were recorded in a notebook.

6.12.4. Actions Taken

As with the medial stage experiments, the two most common reductive techniques were hard hammer percussion and soft hammer percussion. A lesser used technique, generally restricted to platform preparation, was the use of pressure flaking. One important difference between the medial and late stage experiments was the accuracy, or finesse, required to successfully detach flakes. Because the pieces were generally thinner and the striking platforms were less stout, there was the need for more precise actions.

6.12.5. Actions Not Taken

Indirect percussion was not used at any time during the tertiary stage experiments. There were step, stack, and other termination types found on the surface of the original Embarras Bipoints so it was felt that these types of results could be left unresolved. Bipolar percussion and other early stage techniques were not used.

6.13. Concluding Remarks

This first half of the chapter provides a discussion of the various flintknapping techniques and how they may be applicable to the experiments. The second half of the chapter is a fairly detailed account of the three stages of experiments done in order to produce Embarras Bipoints. The results of these experiments will be outlined and discussed in the following chapter.

Chapter 7
Results and Interpretations

7.1. Introduction

So, the experiments are done, what happened? In this chapter I will try to make some sense of what happened. The first observation I made, and probably the most obvious for anyone doing experimental work, is one can get sensory overload! Obtaining a balance means figuring out what may or may not be important. The second, very important, observation made was I would never be able to interpret everything that happened during the experiments. The best I could hope for and what I have tried to do here is provide as many useful observations as possible and be humbled by what I could not.

The chaîne opératoire of material culture can be conducted on many levels. A macro-scale chaîne opératoire has been compiled to introduce the results of the experimental work (See Figure 7.1). A more in depth chaîne opératoire will be provided later in the chapter.

The first stage is the acquisition of raw material. Stage two is the testing and/or spalling of the toolstone. At this stage the piece or pieces will either be kept for further work or rejected. Stages three through six are a generalized representation, based upon some of the identifiable debitage, of what the piece will go through to be transformed to a completed tool. The ordering may appear hierarchical but at any point during the reduction sequence a resharpening flake, for example, may occur prior to a thinning flake. The medial stages are far too complex to present without over simplifying the overall sequence. The last stage is a completed Embarras Bipoint.

The experiments were done in stages from early stage experiments through to tertiary stage experiments where most pieces were made into Embarras Bipoints. To best present the data for each stage of analysis, I will adhere to Lemonnier's four elements of an action (material type, tool types, action, and specific knowledge) but also include a chaîne opératoire and

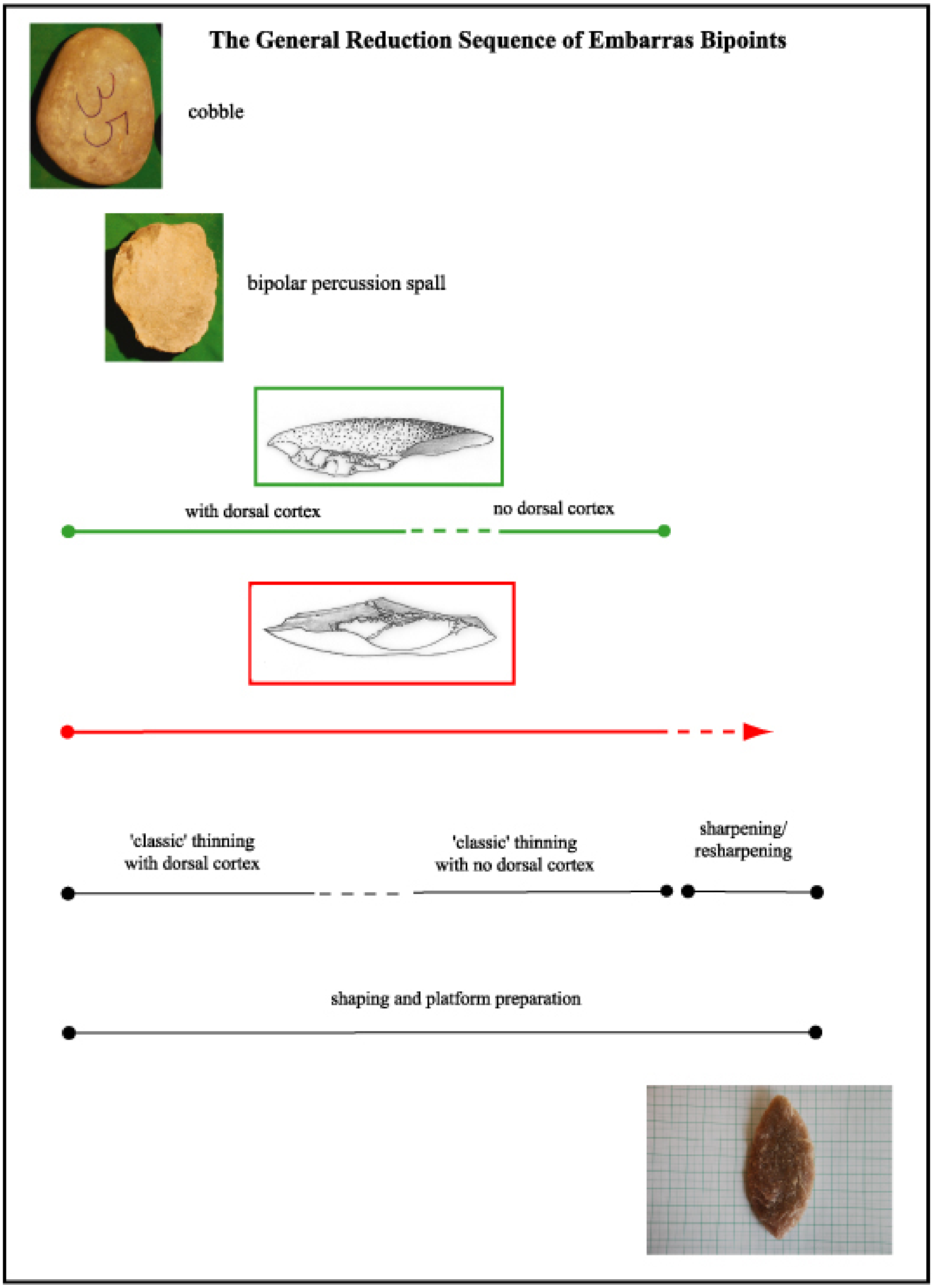

Figure 7.1: The Generalized Chaîne Opératoire of a Replicated Embarras Bipoint

archaeological examples. An action is generally a singular event. Instead I have treated each stage, which includes a multitude of actions, as one action because arguably there is a certain

level of homogeneity to the stages that allows these events to be grouped as one. Following the discussion of material type, tool type, action, and specific knowledge for each stage of the experiment, I have included more general or random observations as they relate to each stage of the experiments. The last section will be a discussion of some of the observation that were made, that do not fit the four elements of an action, but which may be useful for establishing the uniqueness of Embarras Bipoints.

7.2. Results of the Early Stage Experiments

This section is presented in two sections. The first section deals primarily with collecting quartzite and the second section with creating useable spalls from the quartzite that was collected.

7.3. Collecting Quartzite

The majority of the experiments started after the stone was collected. The criteria used to pick the toolstone were based on the previous knowledge I had of the toolstone and also on the impromptu learning as I quarried.

7.3.1. Material Type

The material collected for all of the experiments was metaquartzite from south of the Berland River, north of the Pembina River, east of the Rocky Mountains, and west of the town of Edson along the Foothills of Alberta. The toolstone will be discussed in greater detail in the action section for this stage of the experiments.

7.3.2. Tool type

The tools that worked best for the selection of raw material were large, coarse- grained quartzite or dense granitic cobbles for both hard hammer percussion and use as anvils. As always, the appropriate safety equipment such as eye protection, leather for legs and hands, an appropriate workspace, good lighting, and good ventilation were used. When necessary I would use a shovel to dig out any cobbles that I could not get free by hand. The last tools I used were brute strength and a keen eye. Good quarrying practices, as I have learned the hard way, can mean the difference between the acquisition of good solid pieces and the arduous task of having to carrying away large and very heavy amounts of low quality toolstone.

7.3.3. Actions

A number of the cobbles, #1, 2, 9, 16, 21, 24, 25, 26, 29, 35, 36, and 39, were selected based upon the cortex, shape and size and these required no testing. The expectation was that they were, based upon exterior morphology, suitable candidates for these experiments. Three natural spalls, #31, 32, and 33, were selected because they fit into the desired parameters of a spall that could be used. The remaining specimens were tested in some fashion.

The action(s) involved at this stage ranged from observation and selection of raw material, to some manipulation and alteration of the raw material. Obviously, the first two actions are less visible in an archaeological setting because there may not be any physical results. One means of countering this situation was to recognize and select for similar types of cobbles that were dimensionally best suited to produce Embarras Bipoints with the minimum amount of effort. The most productive way to select useable cobbles was to determine features such as colour, cortex, grain size, and overall shape and size. The selection of a cobble based on these characteristics was considered to be equivalent to an action.

7.3.4. Colour

Almost all of the archaeological specimens of Embarras Bipoints are light to medium grey, fine-grained, quartzite (See Table A.1). The only exceptions were Cobbles #10, 6, and 18 which were pink and cobbles #12, 40, and 38 which were dark grey to black. These cobbles were chosen because grey was not exclusively used and other traits such as grain size, shape and size matched those needed to proceed to the next stage of actions

7.3.5. Cortex

There are a number of natural transforms acting upon the cobbles. They have been moved by glacial, colluvial, or by lucustrine forces. Any of the toolstone on or near the surface has been subjected to freeze-thaw action or cryoturbation which exacerbates fractures and flaws in the toolstone. Some of the physical manifestations of these natural transforms include impact swirls, pockmarks, cracks, semi-healed fractures, and freeze-thaw spalls. These manifestations on the cortex can obscure the interior of the stone but with enough practice and observation, these traits can be used to determine the quality of the quartzite cobble.

7.3.6. Grain Size

There is a wide variability in grain size for quartzite. The quartzite sought out and collected for this thesis ranged from phaneritic to almost aphanitic (Johnson 1998:25). In some places in and around the Embarras Plateau, as well as, along Hightower Creek one can find a high proportion of almost aphanitic quartzite. The smaller more metamorphosed the grain, the higher the knapping quality. Interestingly, analysis and observation of each cobble both before and after the early stage experiments found most of the pieces that were successfully worked to be more phaneritic, or slightly coarser grained, which was consistent with the grain size used by Embarras Bipoint makers.

7.3.7. Size and Shape

In order to produce any stone tool, the general rule is to start with a cobble, flake, or spall that is at least one third bigger than the intended finished product. In other words, there is the expectation that there will be a loss of one third the length, width, and hopefully thickness. This amount of loss is known from these experiments and previous workings with quartzite. All of the cobbles and spalls collected for these experiments were considered large enough to produce an Embarras Bipoint (See Table A.5). The average length of the collected cobbles/spalls was 14.5 cm, and width was slightly more than eleven and a half centimetres (11.7 cm). The thickness of each cobble was not considered because the expectation was that pieces thinner than the average Embarras Bipoint (11 mm) would not be collected and/or used. However, each piece was selected on the basis of cross section and how that would minimize the amount of work needed to complete the experiments. The most common cross section shapes were bi-convex, bi-plano, and plano-convex.

The selection of appropriate cobbles based upon their shape was crucial to this experiment. One of the main tenants for identifying Embarras Bipoints is the less intense flaking on the ventral surface of the tool. If there is less flaking on the ventral surface, then one can make the assumption that the shape of the ventral surface was close to ideal relatively early in the chaîne opératoire. As seen in Table A.1 the most common cross sections were plano-convex and bi-convex which indicates that a relatively flat ventral surface was the ideal shape for spalls selected at this stage. The types of actions, or flintknapping techniques, which will produce this type of ventral surface were either bipolar or throwing, ‘monkey’, percussion. So, cobbles and or spalls with a plano-convex or bi-plano cross section or that could produce these types of spalls when broken were selected for.

7.3.8. Specific knowledge

There are fracture mechanics that have to be met to consistently produce desirable results. In order to successfully obtain usable toolstone one does need to understand fracture characteristics of a toolstone even if it is only on a rudimentary level. Knowing the telltale signs described as actions above (i.e. colour, cortex, grain size, and shape and size), will optimize the chances of successfully obtaining good toolstone. Yet, regardless of a person’s knowledge level about acquiring toolstone, the process can be very useful for learning/observing new traits about the stone being used. For example, when the cobble is split an internal fracture or texture change in the cobble that was not detectable from the outside becomes visible. This may affect the outcome later in the reduction sequence.

7.3.9. Chaîne Opératoire

The chaîne opératoire for the selection of a quartzite cobble (See Figure 7.2), suitable to make an Embarras Bipoint would have to be very simple. A cobble would be observed, assessed and then either selected for or discarded. This action of cobble selection would most likely be based on or related to the colour, cortex, grain size, shape, and overall size.

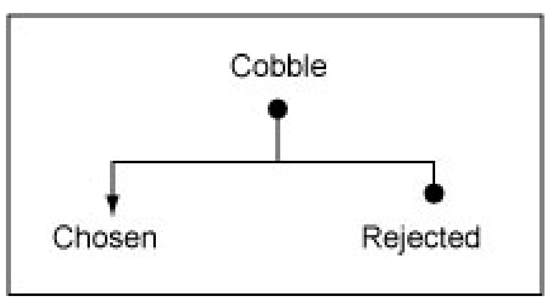

Figure 7.2: The Chaîne Opératoire of Cobble Selection

7.3.10. Archaeological examples

Identifying an archaeological example of an unmodified cobble that may have been selected to produce an Embarras Bipoint is unlikely. One example would be a cobble(s) which has been brought to a site but never used. Another example would be an unmodified cobble among the detritus of cobbles that were intentionally broken. Of course, Embarras Bipoints were reduced from larger pieces of lithic material be they cobbles, spalls, tabs, or lenses; therefore even without absolute proof, this stage in the chaîne opératoire had to exist.

7.3.11. Discussion

One observation I made when making core tools is that the reduction sequence will be influenced and sometimes directed by the type of core involved. For example, most if not all the tools made for these experiments were started from rounded cobbles of quartzite. To work rounded cobbles there are certain actions that have to be performed and others which will not work. To produce a flake one cannot use an obtuse-angled striking platform, which is what one has with a rounded cobble. This means that in order to produce a flake the rounded cobble has to be modified. Splitting the cobbles either using bipolar percussion or the 'monkey/throwing' technique, produced halved cobbles that had the right type of platform morphology.

Conversely, if one was making a core tool from a tablet or block-shaped core, for example Edwards Plateau Chert, the initial reduction sequence will be different. Tablet cores are more likely to have appropriate striking platforms right from the beginning, or they can be produced with less drastic measures than with rounded cobbles.

The very interesting result of this observation is; the debitage resulting from the initial actions of creating a tool will reflect the core type being used. Knapping a tool from rounded cobbles will results in more bipolar detritus, less complex striking platforms, and more curved waste flakes (in longitudinal cross section). Conversely, tablet core tools will produce more early stage shaping flakes, more complex striking platforms, twisted platforms, and flatter flakes (in longitudinal cross section).

7.4. Creation of Usable Spalls

There will be some overlap with this stage and the earlier material acquisition stage. Testing the quality of a cobble can involve splitting a cobble and producing an appropriate spall to work whereas the acquisition of quartzite can be purely observational. The action(s) of choosing appropriate toolstone and creating a spall or split cobble can be done simultaneously but I felt they are significant enough to warrant separate discussions.

7.4.1. Material Type

As previously mentioned, all of the toolstone used was fine-grained cobble quartzite collected from the Hinton, Alberta area. One of the criteria for the data set of archaeological examples, which will be discussed later, was that the artifacts had to be made from a similar material and have similar metric dimensions. All of the spalls, flakes, and split cobbles were made from the cobbles selected in the previous section.

7.4.2. Tool Types

The two principal tools used for the creation of usable spalls were a large melon- sized hammerstone made from coarse-grained quartzite and a basketball-sized anvil stone also made from quartzite. All of the cobbles had been collected previously and brought to my home. All of the actions done at this stage were carried out in my back yard, on a gravelled parking pad, with a wooden fence as a back drop to stop most of the errant flakes and shatter. The appropriate safety precautions were taken such as a large thick leather pad to cover my lower extremities, gloves, long sleeved shirt, and safety glasses.

7.4.3. Actions

The goal was to produce clean spalls of an appropriate size with a plano-convex to biconvex cross section. The two primary types of actions that produce this type of spall were either bipolar or ‘monkey/throwing’ percussion. Direct hard hammer percussion did not work well for this stage of experimenting because the core and tools were too big for accurate control. The reason bipolar percussion worked well was this technique (i.e. action) consistently produced spalls with a reduced bulb of percussion, creating a flat ventral surface. The use of an anvil allowed the cobble to be securely handled increasing the chances of accurately spalling the cobble. The anvil also was found to rebound the downward energy that was being transferred from the hammerstone into the cobble meaning less energy (work) was required and or lost breaking a cobble. Throwing percussion worked well and, after some practice few pieces were lost from being improperly thrown. One can break up larger cobbles fairly easily because a lot of downward energy can be produced. The downside of throwing percussion is the cobbles rebound off the anvil in an unpredictable manner and the resultant spall(s) can fly quite a distance. The regular occurrence of sore shins and the search for wayward spalls may have been enough of a detriment to make throwing a secondary action or one only used sparingly.

7.4.4. Specific Knowledge

One of the best parts about splitting cobbles is that these actions require the least amount of prior knowledge about working stone. This does not mean spalling is as simple as hitting two stones together but, with only a minimal amount of knowledge about how stones break, one can produce spalls. With a keen eye one will learn exponentially about how spalls and flakes are made and this can be transferred to later stages of the chaîne opératoire.

As mentioned previously, a general rule of flintknapping is that one can expect to lose up to one third of the length and width of a spall when making a bifacial tool. This means that in order to make a bifacially worked stone tool that is 12 cm long and 6 cm wide the original spall has to be at least 15 cm long and 9 cm wide. The average length of an Embarras Bipoint is 11 cm with a width of 5.5 cm. All of the cobbles and resultant spalls, flakes and split cobbles selected to participate in this stage of experiment were much larger than those dimensions. The average length was 14.5 cm and the width was slightly over eleven and a half centimetres (11.7 cm).

Another criteria used to distinguish acceptable spalls was the cross section. Bipolar percussion produces relatively predictable results where the ventral surface will have a flatter cross section. Most of the cobbles that were successfully split met this criteria and were kept for later experimentation. Throwing percussion produces flat ventral surface spalls less predictably, so some were kept and others were not worked past this stage. Hard hammer percussion flaking at the scale of creating large enough pieces to be worked into Embarras Bipoints had a number of previously known and undesirable results. For example, an appropriate sized flake would in many cases have a proximal end that was too thick and a distal end that was too thin. Thus, thinning the proximal end would be too labour intensive while at the same time the thinness of the distal end reduced the number of potential actions that could be done on the ventral surface following the chaîne opératoire I believe was used at this stage. Also, an exaggerated bulb of percussion is a common feature of hard hammer percussion which contrasts with the diffused to almost absent bulb seen on most of the known Embarras Bipoints. Another factor making hard hammer percussion unlikely is that there has to be an appropriate striking platform. On a rounded cobble there are very few instances where an appropriate striking platform can be found.

7.4.5. Chaîne Opératoire

The chaîne opératoire of the Early Stages of Reduction can be relatively simple in design. In many cases there needed to be only one successful action in order for a piece to be completed to this stage. To best illustrate the action(s) necessary to take a cobble from an unmodified state to an early stage preform/spall see Figure 7.3.

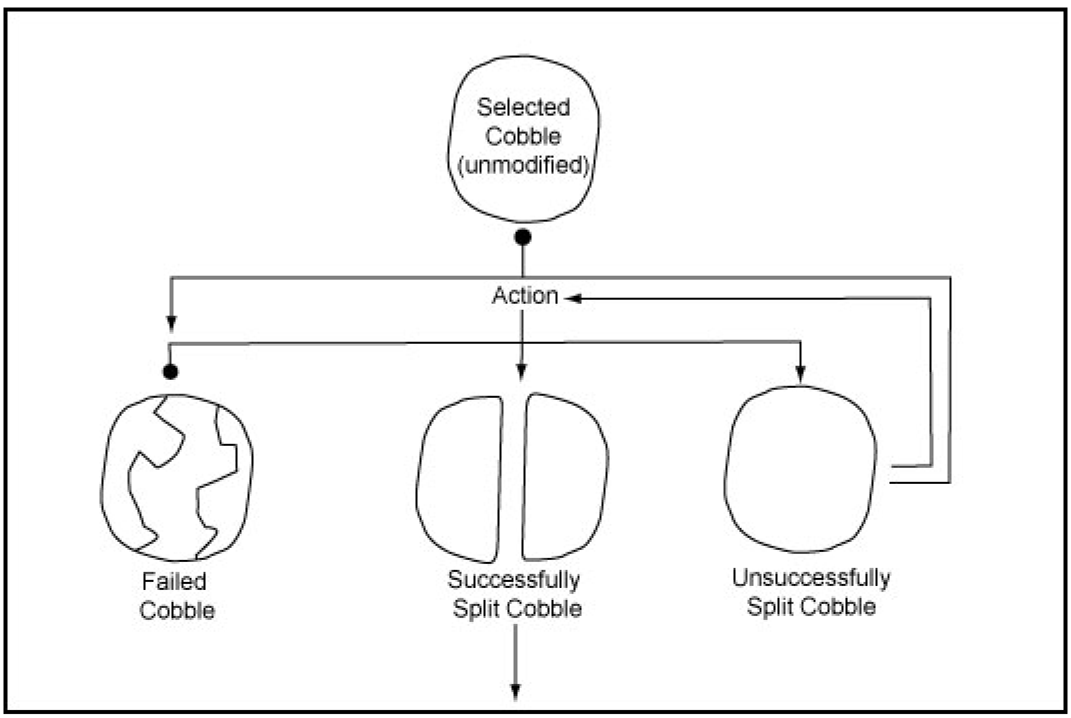

Figure 7.3: The Chaîne Opératoire of an Early Stage Spall

The starting point is a previously selected cobble of quartzite and the end point is where a cobble has been split, creating either a usable spall or unusable shatter. An action is taken, for example either bipolar percussion or throwing percussion. There are three possible results. One outcome is the cobble fails and breaks into too many pieces to be useful. This usually happens when there are pre-existing flaws in the toolstone or the action was poorly executed. Another outcome is the cobble remains unmodified and depending on whether the cobble has too much internal damage can either be discarded as a failed cobble or the action can be repeated. The third result, the desired outcome, would be that the cobble splits producing one or more useable spalls that can be advanced to the next stage of reduction.

7.4.6. Archaeological Examples

There is no way to truly know if the examples provided in Table 7.1, are valid specimens of spalls that were intended to be made into Embarras Bipoints. Their inclusion was based upon a number of different criteria. The most important variable is they were recovered from sites

Table 7.1: Archaeological Examples of Early Stage Spalls

Site	Catalogue Number	Type	Reference
FgQe-14	1317, 4065, 4697, 442, 536, 2889, 458, 2873	Bipolar Spalls	Calder and Reeves 1977
FgQe-14	1952	Thrown Spall	Calder and Reeves 1977
FgQe-16	583, 521, 429	Bipolar Spall	Calder and Reeves 1977
FgQe-16	753	Thrown Spall	Calder and Reeves 1977
FgQe-16	1044	Tested Cobble	Calder and Reeves 1977
FhQf-10	999 (plus more)	Bipolar Spalls	Hunt 1982
FlQj-27	13	Bipolar Spall	Meyer et al. 2008
FgQf-16	2272	Thrown Spall	Meyer and Roe n.d.

with Embarras Bipoints so that a temporal and spatial connection could be inferred. They had to be made from local toolstone and they had to have metric dimensions that were minimally one third larger than the average metrics for Embarras Bipoints. They had to have been produced by either bipolar percussion or throwing percussion. Lastly, these specimens had to have either a plano-convex or biconvex cross section. These criteria were believed to be the most representative traits of early stage spalls and preforms in the chaîne opératoire of Embarras Bipoints.

7.4.7. Discussion

There were a number of observations made during this stage of the experimental work. Some are related to the fracture mechanics of the stone, others on the agency of making stone tools, and some on technical insights gained from doing these experiments. One interesting discovery was that a solid, high quality cobble of quartzite would produce only a minimal amount of debitage and shatter when split by bipolar percussion. The poorer the quality of the toolstone the more fractures and internal flaws already in the stone, the greater the chances of producing shatter and smaller bipolar percussion flakes. On the contrary, a solid, high quality cobble of quartzite, because of the integrity of the stone, was on occasion more difficult to split. One observation that could be offered is that a mostly fracture-free cobble of high quality quartzite is optimal when trying to produce large spalls. Any micro fractures could be manipulated to minimize the amount of effort that is required to split a large cobble of quartzite.

Before acquiring and working with quartzite I believed quartzite to be a difficult toolstone to knap into stone tools. When compared to the flints, cherts, and obsidians the materials I was accustomed to working I felt quartzite would be nearly impossible to work. Now, my impression of quartzite has dramatically changed to the point where I believe it to be superior to many toolstone for producing almost any type of stone tool.

Another insight was the potential analogy that could be made between modern flintknappers and those who made Embarras Bipoints. Based in the idea of community of practice, when there is the need for two-person bipolar percussion there will be a social hierarchy associated with that action. Two-person bipolar percussion requires one person to hold the core on an anvil and the other person to manipulate the large hard hammer percussor. In order for this to be accomplished, one person has to accurately hit the striking platform on the core with the right amount of energy to produce a result while the other holds the core. From this one could make the dual assumption that the person working the hammerstone had to have the proper skill level to complete the action successfully and/or the person holding the core had to trust the other not to damage their hands and fingers. This simple example of the polemic relationship of two-person bipolar percussion may be tied into status, prestige, or any number of other cultural milieus.

Another point to be made is that at this stage of the manufacturing process, there has to be more emphasis on technology, both for the present experiments and the original makers of Embarras Bipoints, and less on cultural influence(s) on those actions. Quartzite can be a malevolent, but workable, toolstone. There are only certain techniques that can be used to manipulate this toolstone. Bipolar percussion and the monkey/throwing techniques are by far the most successful actions for producing the desired results. The question could be asked, was one technique or action more favoured culturally, than the other or did the makers of Embarras Bipoints regard them as equally viable options? Until there is a much greater data set representing one technology versus the other, the answer has to remain unanswered. However, from this experiment it is clear that these two techniques were technologically the most successful and regardless of the cultural setting were the most likely actions taken.

7.5. Results of the Medial Stage Experiments

There were 29 specimens successfully completed to the medial stage. This means at the completion of the primary stage but prior to the medial stage experiments 20 pieces were discontinued. These pieces were deemed to be unusable either because the piece required too much effort or there were major flaws that could not be worked through. The volume of debitage produced for this stage of the experiment was 18 to 19 litres based on the measurement from a 20 litre pail.

7.5.1. Material Type

These experiments are a continuation of the earlier stage experiments, so the cobbles used were all metaquartzites. All of the quartzite pieces were ones that met the prerequisite criteria of the early stage experiments, had flaws that were dealt with during the primary stage, or bypassed the spalling stage.

7.5.2. Tool Type

The tool types used in these experiments included a variety of antler billets (both moose and white tail) and hammerstones (made from granitics, sandstone, and quartzite). Moose antler billets have the best qualities for producing large thin flakes and were the dominant tool used. One characteristic of using antler billets at this stage of the experiment was that a significant amount of time for each action was directed towards tool maintenance. The reason for this is that each action required a significant blow and therefore an aggressive contact between the billet and the specimen being worked. Tool maintenance involved grinding out by the use of a rasp, file, or piece of coarse sandstone any pitting that may have accumulated on the surface of the billet. The smoother the contact between the billet and the toolstone being worked, the better the chance of a successful action. If an antler billet is pitted, the greater the chance for multiple impact points, inadequate contact between the billet and the toolstone, and/or imprecise contact between the billet and the toolstone.

The use of hammerstones was mostly for minor shaping actions and platform preparation. On rare occasions when a striking platform was too sturdy for a flake to be detached with a soft hammer percussor, a hammerstone was used to either take off a small flake to thin the platform area or to remove a complete thinning flake.

7.5.3. Actions

The two predominant actions in the creation of medial stage preforms were soft hammer percussion and hard hammer percussion. Soft hammer percussion was used for the removal of large thinning flakes and smaller shaping flakes. Hard hammer percussion was used mostly, if not exclusively, for platform preparation flaking and the removal of over prepared striking platforms. Depending on the size and thickness of the spall being worked, each piece could be reduced in an average of thirty to forty actions. Large thinning flakes could be removed with sturdy, thin, well prepared, platforms. For this stage of experimentation the production of a sturdy platform required only a minimal amount of preparation flaking and grinding because the pieces were generally thick. However, a hefty swing with accurate contact with the striking platform was the ultimate goal to minimize any troubleshooting for the tertiary stage experiments. Much of the focus at this stage was on removing mass, as well as working around and removing internal flaws in the stone. In a number of cases, likely the result of the toolstone, flakes terminated prematurely, leaving small hinge or thumbnail terminations that had to be removed before proceeding.

The general reduction sequence was kept fairly consistent for each piece, with the removal of large thinning flakes from the dorsal surface and only platform preparation and shaping flakes removed from the ventral surface. The following examples are a more detailed description of the experimental work. They were chosen because they corroborate the prescribed chaîne opératoire, as well as highlight actions or results of actions that may be potential characteristics of Embarras Bipoint manufacturing processes.

Spall #30 was a thrown spall that had the appropriate dimensions to be worked into a preform. This piece had little to no visible bruising or crushing on the dorsal surface or the exterior edges. Some of the soft hammer percussion flakes removed from the dorsal surface were up to five centimetres in length. There was only a minimal need to modify the ventral surface. Of the thrown spalls made for these experiments this was one of the more successful pieces completed to a medial preform.

Natural spall #33 was a specimen, even with cortex on all surfaces, that had an appropriate overall shape and a limited number of observable flaws. There was no need for any prior modification, so this piece was worked from a raw state to a medial stage preform. The dorsal surface, after one series of soft hammer percussion flakes were removed, did exhibit some bruising and crushing but this was close to the surface and did not interfere with any of the later flake removals. All of the flakes removed were less than five centimetres in length, which was appropriate for the overall size of the piece. The predetermined ventral surface was only modified to prepare striking platforms for the dorsal surface. The medial area on the ventral surface had cortex at the completion of the medial stage experiments.

Spall # 15 was worked and rejected after only six actions. The reasons for not continuing were; the exterior surface had extensive crushing and bruising so there were numerous incipient Hertzian cones, internal fractures and partially healed fractures. Almost every soft hammer percussion action resulted in either the shattering of the lateral edge or a step termination. The interesting result of working #15 was that the spall, after only six actions, resembled an expedient chopper or possibly a multidirectional core fragment. This could mean that some of the expedient 'chopper' or core fragments recovered archaeologically could be unfinished preforms that were intended to be more formalized tools.

Cobble #25 was split creating bipolar spalls ***A*** and ***B***. Bipolar spall #25-A was completed to the medial stage and had a plano-convex transverse cross section. There were a number of internal fractures in the material but they were worked through or under with soft hammer percussion. The proximal and distal ends had crushing associated with the initial bipolar splitting but this proved to be inconsequential. Bipolar spall #25-B was not as successful. The piece failed because of end shock trauma associated with internal flaws in the toolstone and inappropriate support. One lateral edge had a rotten or heavily damaged area and there was crushing on both the proximal and distal ends that aided in the failure of this specimen.

Cobble #26 was split into spalls ***A*** and ***B***. Bipolar spall #26-A was completed to the medial stage with a plano-convex transverse cross section. The crushing on the proximal and distal ends and partially healed fractures in the toolstone proved to be troublesome when trying to remove large soft hammer percussion flakes from the dorsal surface. Some of these trouble spots were dealt with at this stage of the experiment but others where left to be dealt with during the tertiary stage of reduction. Bipolar spall #26-B was more successful. A number of the flakes detached by soft hammer percussion exceeded 8 cm in length. There was crushing associated with the bipolar percussion spalling and there were a couple of partially healed fractures, especially along the medial axis, which were believed to be potential trouble spots for the tertiary stage of reduction. However, with only a couple of soft hammer percussion series, this piece was completed to a medial stage preform.

Bipolar spall #11 was successfully completed to the medial stage. Initially, this piece was not expected to be workable because of the number of fractures and bruising in the material. Also, this piece had a triangular transverse cross section which meant the ventral surface required more reductive actions than prescribed in the chaîne opératoire. However, with only a short series of flakes, some over 8 centimetres long, the piece was completed. The reason this piece was chosen was to see whether a specimen with a less than desirable cross section, i.e. not plano-convex or bi-convex, could be reduced following a prescribed sequence of actions and have comparable results.

Another piece, ***bipolar thinned cobble #7***, was worked to the medial stage but could have been discarded at the primary stage. This piece had two large bipolar percussion spalls taken off one end and the other was rounded and largely unmodified. In order to reduce the rounded edge a significant amount of work had to be applied to the ventral surface. Even though the rounded edge had a number of healed fractures, crushing, and bruising from the primary stage this piece was successfully completed to the medial stage following the chaîne opératoire established for this experiment.

7.5.4. Specific Knowledge

Next to the initial stages, splitting cobbles, the production of medial stage spalls requires only a moderate amount of technological skill. The pieces are still thick enough that precision striking to remove large, mass removing, flakes does not require a keen swing and well prepared striking platforms. A more appropriate appraisal of the skill sets needed to produce medial stage preforms would be midway between the brutish skill of splitting cobbles and the dexterous precision of finishing the tool. An appropriate amount of time and effort was and would have been needed to acquire the skills needed to complete a piece to this stage.

One expectation was that the greatest loss in length and width of a piece would occur during the medial stage of reduction. The debitage produced to this stage included large to medium-sized shattered pieces, large primary flakes, early secondary, and secondary flakes, as well as large thinning flakes with simple to complex dorsal and platform scarring and shaping flakes with simple to complex dorsal and platform scarring. The primary stage of reduction can occur with very little loss of either the length or width of a piece. Similarly, the goal of the tertiary stage is to finish the tool with little loss in either the length or width of the tool. The knapping of the spalls for the medial stage experiments did result in the greatest reduction in length and width. Thus, of the three stages (early, middle, and tertiary) the medial stage would be the most visible in the archaeological record because of the larger average size of the resultant debitage.

An interesting change in my flintknapping approach was the necessity to 'fool' the energy needed to produce a flake. To explain this I need to anthropomorphize the energy used to produce a flake. As energy travels through the quartzite, after being introduced as either a dynamic or static load transfer, the energy prefers to follow the path of least resistance leaving a fracture in its wake. If the energy is travelling too close to the surface, it can in some cases, regardless of how far it could actually travel through the toolstone, terminate prematurely. To 'fool' the energy into thinking that it is not as close to the surface it is necessary to press the piece into a surface, i.e. my leg, thus creating the illusion of more toolstone to travel through. This allows for a more hefty swing, meaning the flake fracture travels farther, yet has a relatively thin cross section. This technological observation was also used for the tertiary stage experiments.

7.5.5. Chaîne Opératoire

The chaîne opératoire for the medial stage experiments is very complex and repetitive. To simplify the process, a condensed chaîne opératoire, Figure 7.4, was created to explain the evolution of a specimen from a spall to a medial stage preform.

A successfully completed spall that was large enough to be reduced and had a minimum number of flaws was chosen. The intended action (identified as 1 in Figure 7.4) was decided upon, in this case to strike a small to medium-sized flake off the ventral surface. At the completion of this action there were three viable outcomes. If the flake was detached successfully, it was worked further. Second, if the specimen broke, either as a result of the flaking action or because of an internal flaw, the piece was not worked further. Third option, if there was no change in the piece the action was either repeated or the piece discarded

If the flake was successfully detached from the ventral surface, the next action would be to prepare a platform area to remove a flake from the dorsal surface using the previous flake scar as a guide. This is a good example of where the chaîne opératoire has been condensed. A more detailed sequence of events would involve separating out each physical manifestation that occurred to the piece and treating each as actions. Once the striking platform is prepared the piece is ready to move onto the next action.

The next action is chosen (identified as 2 in Figure 7.4) is the removal a large thinning flake from the dorsal surface. There are three possible outcomes of this action. The first is the flake is successfully detached from the dorsal surface and the piece can continue to be worked into a preform. A second possibility is that the piece breaks. The break could result from a number of reasons, such as internal flaws or the inappropriate swing of the soft hammer percussor. The third possible outcome is there are no visible results, so platform preparation and action two can be repeated or the specimen can be discarded.

All of the actions are predicated by previous actions and influence the actions that follow. The number of actions that are required to take an unmodified spall to a completed medial stage preform depends on the size of the piece being worked, the type of actions being performed, the skill of the flintknapper, and the quality of the stone being worked. At any point along this chaîne opératoire the piece may be deemed worthless and discarded. The pieces that were worked for the experiment did follow this general chaîne opératoire, with more intense flaking occurring on the dorsal side and only platform preparation, some shaping, and a minimal amount of thinning of the ventral surface.

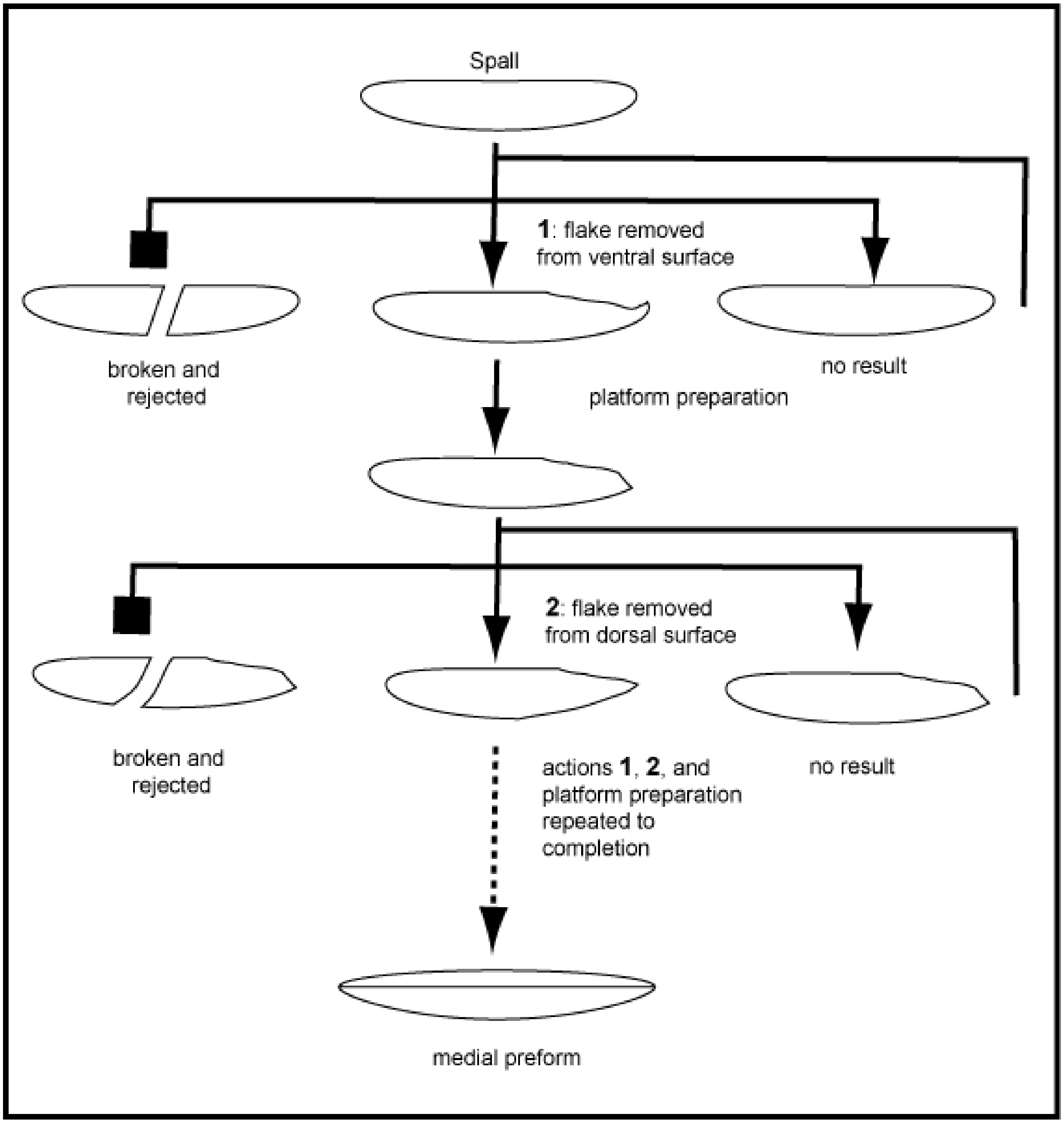

Figure 7.4: The Chaîne Opératoire of Medial Stage Preforms

7.5.6. Archaeological Examples

The preforms in Table 7.2 were selected based upon four main criteria. They had to be large enough to produce an Embarras Bipoint from. They had to have an appropriate cross section, either plano-convex, bi-plano or bi-convex. They had to exhibit a flaking pattern where the dorsal surface was more complex than the ventral surface. Lastly, and most importantly, they had to come from archaeological sites with Embarras Bipoints. Regardless of the original intent of these artifacts, which never came to fruition because they were broken during the manufacturing process or flawed, they were selected based on their physical characteristics and not as definite medial stage Embarras Bipoint preforms. This type of emic identification is beyond the scope of this thesis.

Table 7.2: Archaeological Examples of Medial Stage Preforms

Borden Number	Catalogue Number	Material Type	Length (mm)	Width (mm)	Thickness (mm)	Reference
FgQf-16	139	quartzite	116	24	24	Meyer 2003:419
FgQf-16	1252	quartzite	115	90	34	Meyer and Roe n.d.
FgQf-16	1254	quartzite	120	80	25	Meyer and Roe n.d.
FgQf-16	1255	quartzite	80	40	17	Meyer and Roe n.d.
FgQf-131	2	quartzite	63	50	16	Meyer 2003:418,423-424
FhQf-10	743 and 769	quartzite	148	103	27	Hunt 1982:93, 95
FhQf-10	1000	quartzite	155	132	443	Hunt 1982:120, 122-123
FkQk-9	36	quartzite	86	63	16	Meyer et al. 2008:510, 518
FkQk-15	47	quartzite	155	141	31	Meyer et al. 2008:508, 518

Finding archaeological examples of the debitage that was exclusively related to the production of Embarras Bipoints was difficult. The reason is this type of debitage has many overlapping similarities with more 'classic' biface debitage. However, after analysing some of the lithic material from FgQf-16, three flake types could be tentatively identified as relating to the production of Embarras Bipoints.

In the summers of 2005 and 2006 I had the opportunity to excavate FgQf-16, a site located along the Lovett River, on the Embarras Plateau, near the hamlet of Robb. The reason I was interested in the Upper Lovett Campsite (FgQf-16) was that a number of in-situ Embarras Bipoints and well over 50,000 other artifacts had been recovered. I felt with this data set I might be able to reconstruct at least a portion of the chaîne opératoire for making Embarras Bipoints.

One part of the ongoing research project of FgQf-16 has been the analysis of the lithic debitage and stone tools (Meyer 2004, 2005, 2005a, 2005b; Meyer and Roe 2006a, 2008a, n.d.; and Roe 2005a, 2005b). By far the dominant toolstone for both the tools and debitage recovered was quartzite. This allowed us the opportunity to focus on one lithic material without the 'clutter' of other materials. The analysis of the debitage was done in two stages. The first stage was a Sullivan and Rozen (1985, 1987), mass analysis that separated the debitage into four main categories; complete flakes, broken flakes, flake fragments and shatter. Also at this stage, because we felt that the colour was important, each of the four main categories of debitage was separated based on the colour of the quartzite. The mass analysis established where the greatest concentrations of debitage were within the excavated area. The second stage of analysis was focused on the areas that had the greatest concentration of artifacts or where we felt the distribution of other artifact types (i.e. tools) might be indicative of activity areas. Also, the goal of the second stage was to get a better understanding of technological behaviour and piece together the chaîne opératoire of Embarras Bipoints and the other tool types found at the site.

The second stage of analysis separated the debitage into a number of categories that best reflected the technological action that was used to produce each individual piece. The categories were based primarily on striking platform features, but other morphological features were not ignored. From this I was able to identify a number of flake types that may be related to or exclusive to the production of certain tool types found at FgQf-16. For example, one flake type was identified as belonging to the chaîne opératoire of Reverse Unifaces (Meyer and Roe 2008a, n.d.). However, there were also three flake types that I believe were a result of the making

Embarras Bipoints. Before I describe these flake categories, it must be stated that these flake types are not exclusive to the production of Embarras Bipoints but, in mass, they represent a technological pattern that best relates to at least part of one chaîne opératoire for Embarras Bipoints.

One of the ways to interpret a piece of debitage is by the physical modifications that had to occur in order for that flake to be produced. Identification was based upon the morphological features found on the striking platform, the dorsal surface, and from observations made prior to and from this experimental work. Seeing and knowing how a particular flake type was produced allowed me the opportunity to identify similar flakes in the archaeological data set.

Flakes with edge bite platforms are one of the types identified in the data set from FgQf-16. A more in-depth discussion can be found later in this chapter. They were identified and used to interpret the chaîne opératoire of Embarras Bipoints.

Another category of flake that is relevant to the medial stage of reduction is one where the striking platform had to be dropped below the centre line or longitudinal axis of the tool in order to produce a flake that could travel further into the body of the piece. When this occurs, there is one obvious feature that can be identified on the striking platform of the flake. Dropping the striking platform below the centreline or axis requires one or a series of small, usually hard hammer percussion, flakes be taken off the surface opposite to the larger flake being removed. These accessory actions result in either a shovelled or triangular appearance, with overlying or stacked hinge terminations on the ventral side of the striking platform of the flake.

Another feature of this flake type is the minimal, or lack of, edge modification on the dorsal portion of the striking platform. During the medial stage of reduction, another common morphological feature of this flake type is the presence of cortex on the dorsal surface and/or a low number of dorsal scars. Lipping on the ventral edge of the striking platform, and a curved longitudinal cross section of the body of the flake are other characteristic important features. This flake type (See Figure 7.5) was observed both in the analysis of FgQf-16 and during the medial stage experiments.

Figure 7.5: A Flake with an Edge Dropping Platform (A.J.M.D. drawing)

This flake type fits well into the greater chaîne opératoire of Embarras Bipoints especially with an operational sequence that starts with a plano-convex spall and follows a minimal effort for maximum result approach. This is because, if the modification of the ventral surface is kept to a minimum and the reductive actions are mostly focussed on the dorsal surface, then the lateral edge needs to be continually dropped below the centre line, towards the dorsal surface, so that more substantial flakes can be removed.

The third category of flake that may be relevant to the production of Embarras Bipoints, but can definitely be associated with the production of any bifacially worked tool, are large thinning flakes. A large thinning flake can be described as a flake that exhibits a moderate to heavily scarred striking platform, a platform that is commonly at least twice as wide as it is thick, and lipped, a diffuse bulb of percussion, and a curved longitudinal cross section. The distinction, for those related to the production of Embarras Bipoint, being those with cortex on the dorsal surface. During the medial stage of reduction, with most of the actions being directed towards the dorsal surface, all of the flakes will initially have cortex on the dorsal surface.

Once again, if one starts with a plano-convex shaped spall and follows the maximum results with minimum effort principle then, especially during the medial stage of reduction, this type of flake should be common. Many of the flakes produced during the medial stage experiments did exhibit these qualities and there were numerous examples in the FgQf-16 assemblage. This means the argument could be made for this flake type being part of the chaîne opératoire of making Embarras Bipoints.

7.5.7. Discussion

One observation was the closer the transverse and longitudinal cross section was to plano-convex or slightly bi-convex, the greater the chances of successfully completing a piece to the medial stage. In contrast, large fan flakes or spalls with a hinge termination that have an exaggerated bi-convex cross section require a lot of work to complete to a medial stage. The rounded edge on the distal end of the spall require the edge to be turned (Whittaker 1994:136) and the ventral surface needs a lot of thinning actions to make the piece worth finishing.

A very interesting and informative observation was that keeping the striking below the centre line of the biface (See Figure 7.6) vastly increased my chances of a successful action. The centre line, in this circumstance, is the line that divides the dorsal from the ventral surface in transverse or longitudinal cross section. With some toolstone, such as obsidian or softer toolstones, the striking platform can be equal too or even slightly above the centre line and a

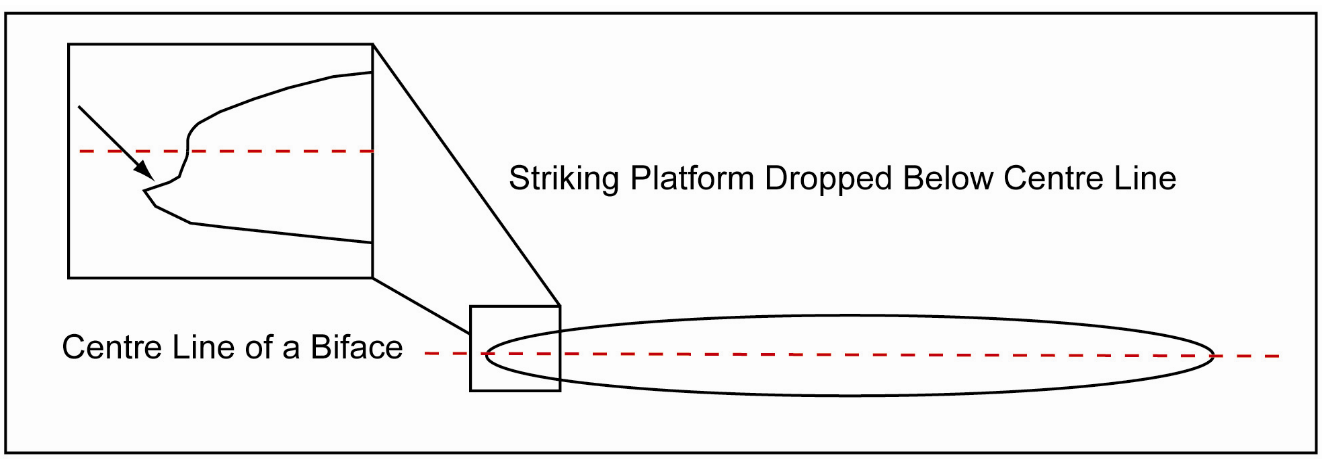

Figure 7.6: Centre Line of a Biface

flake will detach. Working quartzite with the striking platform below the centre line optimizes the chances and minimizes the energy necessary to initiate a fracture.

One of the objectives at the medial stage was to remove as much unwanted mass as possible with the least amount of effort (i.e. number of actions). Another objective was to deal with pieces with internal flaws by either removing or working around those flaws. Much of the quartzite observed and/or used in this thesis had issues with internal flaws in the toolstone. This could be one explanation for many of the shatter-like bifaces found in the archaeological record. In many ways the objectives of the medial stage of reduction were not only to thin and shape a biface but to remove flaws that could hinder or interrupt the tertiary stages of reduction.

As mentioned many times in this thesis, quartzite is a difficult and strenuous toolstone to work with. One has to be constantly vigilant about the angle of the percussive swings and, more importantly, the amount of energy put into each action. Any dynamic loading that does not have the energy to completely remove a flake will result in a disheartening distal termination. One termination type that I found very interesting were the flakes that had feather terminations but had not completely detached from the piece being worked. The corrective action used most was to set up a striking platform on the opposite side that was in line with the still attached flake with the intention of removing the attached flake as well as some of the material below. Another solution was to shatter the striking platform area of the attached flake, with the anticipation of producing a squared edge. This squared edge could then be used as a seat for an antler punch. Using indirect percussion I could then detach the original flake. I am not sure how visible these problem solving actions would be in an archaeological setting; however, they worked in the experiment and would have been viable options in the past.

One unexpected observation made about the quartzite was the higher the quality, the greater the chance of internal flaws, bruising and crushing. The pieces where the quartzite was almost like chert usually had too much previous damage to be of any use for making Embarras Bipoints; however, these super fine-grained quartzite cobbles even with all their flaws still produce pieces large enough to make smaller tools. The most successful pieces were those that were high quality quartzite, but with some grainy-ness that made them more resilient. Also, all of the archaeological examples used in this thesis were of similar grade of quartzite.

7.6. Results of the Tertiary Stage Experiments

A total of 18 pieces were completed to finished tools (see Plates 28 to 30). The specimens needed to have very little to no cortex, clean sharp edges, and an appropriate overall shape in order to be considered a finished tool. Five of the specimens, of the 29 medial preforms, failed within the last few actions of being finished. They could not be completed because they broke on internal flaws or as a result of inappropriate actions. Some may consider a forty-five percent (45%) rate to be less than stellar results for this experiment. However, many of the cobbles would have been discarded earlier in the manufacturing process and others acquired, with direct access to more toolstone during the manufacturing process; therefore the success rate would be much different. There was 6 to 8 litres of debitage produced.

7.6.1. Material Type

All of the pieces that had been successfully completed to the medial stage were used for these experiments. The majority of the flaws, fractures, and texture changes in the quartzite was either removed or dealt with in a way that there would be minimal interference with the tertiary stage experiments. Interestingly, the pieces that were of extremely high quality, almost chert-like quartzite, did not make it to the tertiary stage. Conversely, the quartzite with a coarser grained texture, although suitable, was discarded at the primary stage. The pieces that successfully made it to the tertiary stage experiments were of quartzite that ranged from fine-grained to very fine-grained.

7.6.2. Tool Type

The tools used for the tertiary stage were similar to those employed in the medial stage experiments. The primary difference was that some of the moose and white-tailed deer antler billets were smaller and there was a greater use of a sandstone abrading stone for platform preparation. On rare occasions pressure flaking tools such white-tailed deer antler tines, were used to move or modify striking platforms.

7.6.3. Actions

The general reduction sequence for the tertiary stage was similar, only more precise, than for the medial stage. The goal of the chaîne opératoire was to focus most of the flaking on the dorsal surface, with only necessary shaping, thinning, and platform preparation on the ventral surface. More attention was given to preparing suitable striking platforms, accurate swings with the soft hammer billets, and appropriately holding the specimen to minimize perverse, radial, and bending fractures. The following descriptions are a sample of what occurred during the tertiary stage experiments. These examples were chosen to highlight the general sequence of events that all the pieces went through during the experiments.

The first specimen completed to the tertiary stage was ***thrown spall #6***. This was a piece that was originally collected, prior to the experiments, for personal use. The quality of the quartzite was exceptional, except for a number of internal flaws already in the toolstone and others introduced during the spalling process. The dimensions of the piece were well beyond the required measurements to produce even the largest Embarras Bipoint. The cross section was asymmetrically diamond-shaped. Based upon its size, I predicted that I should be able to produce a larger finished product. However, the internal flaws caused a lot of material loss, either through snapped edges along internal weakness or from the repair of step-stack fractures. Also, the diamond-shaped transverse cross section required more thinning and shaping of the ventral surface than if the piece had been plano-convex or slightly bi-convex in cross section. The reductive techniques used included hard hammer percussion for the initial thinning and platform preparation and soft hammer percussion for most of the thinning actions. The end result was the successful completion of an Embarras Bipoint. However, a lot of the material was lost due to internal flaws and the thickness of the piece meant a great deal of work was directed towards thinning it. Even thought the piece was completed, I would predict that a Precontact flintknapper would have discarded this piece prior to completion because of the issues mentioned above.

Preform #26-A was successfully completed to a finished Embarras Bipoint. The only problem with this tool is a large, obvious hangnail fracture associated with a partially healed fracture. The piece ended up with an appropriate shape, a bi-convex transverse cross section, and only a small amount of cortex. Most of the larger flaking was successfully done using a moose antler billet. For this piece, which was quite rare for these experiments, pressure flaking was needed to help prepare striking platforms. In many ways using pressure flaking to make tools of this magnitude is not feasible. The strength needed to produce flakes of any size was beyond my physical abilities. Nevertheless, pressure flaking, although difficult, did successfully assist in preparing platforms for preform 26-A.

Preform #26-B was completed to a finished Embarras Bipoint. Before starting, a partially healed fracture was noted along the medial axis so extra effort was taken to minimize the stress on this potential flaw. Because of the overall shape of this piece, more work was required on the ventral surface than was hoped but the general chaîne opératoire was still acceptable. The ventral surface ended up having a couple of unattached flakes or hangnail fractures and the dorsal surface had two step stack fractures, they were left unmodified. The reason they were left unmodified is that even though they are not aesthetically appealing they did not impede the overall function-ability of the tool. A similar surface feature can be observed on the dorsal surface of FhQg-10-3 (See Plate 2).

Preform #5 was finished into an Embarras Bipoint. At the end of the medial stage experiments one end was still slightly squared, the piece was still relatively thick and there was a healed fracture along one of the lateral edges but the piece was deemed workable. The idea was to see if a less than perfect specimen could be completed following a prescribed chaîne opératoire and still produce a finished piece. One of the more successful aspects of working this piece was that some of the flakes removed from the dorsal surface were over 9 cm in length. A loss of width occurred relatively early in this stage which meant that even with the large mass removing flakes that were obtained the piece ended up being relatively thick. However, it was not outside the range of thickness of some of the archaeological examples.

Preform #4 was completed to a finished Embarras Bipoint. This specimen was not the most aesthetic one made. There was a healed fracture from one of the tips to the medial axis on the opposite lateral edge and this created a short series of step stacks along one lateral edge. However, the edge could be pressure flaked and the rest of the tool had the requisite characteristics of an Embarras Bipoint so it was considered a success.

Preform #3 failed during the tertiary stage experiments. The expectation for this piece was not favourable because it was thick and relatively small. This piece had a healed fracture through the middle and one end was rotten. This specimen was, for some unrecognized reason, difficult to flake and the piece eventually broken while I was trying to thin the rotten end.

Preform #35-A was a failure. There was an inclusion towards one end along the medial axis that was expected to cause problems and the piece had a relatively thick cross section.

During the tertiary stage reduction, this piece broke with a perverse fracture that was caused by an inaccurate swing and being held too firmly.

Preform #39-A failed during the tertiary stage reduction. This piece was made from extremely high quality quartzite and produced flakes up to 8 cm long. However, the ventral surface was slightly concave and there were several partially healed fractures running parallel to the medial axis. The piece broke with a perverse fracture along one of the healed fractures.

7.6.4. Specific Knowledge

The main difference between the medial and tertiary stages of reduction is that more time and patience is required for each specimen. Instead of working two or three pieces from a preform stage to a finished piece without a rest only one piece could be worked and finished before taking a break.

From previous experience working with quartzite and other knappable toolstones, I knew that if a specimen was going to break because of a poorly judged action it would be during the finishing stage. Extra care was taken, though not always successfully, to prevent judged actions.

The sinuous edge, a strong characteristic of most Embarras Bipoints, was predicted to be a result of the flakes being removed during the medial and tertiary stages of reduction. The experimental work showed that soft hammer percussion, the minimal use of hard hammer percussion, and the limited pressure flaking produced a sinuous edge. The different platform types (discussed for the medial stage experiments), predominantly edge bite platforms, remove a portion of the lateral edges creating the sinuous look.

7.6.5. Chaîne Opératoire

The chaîne opératoire for the tertiary stage experiments is relatively similar to that of the medial stage experiments, see Figure 7.7. The most significant differences are that the platform preparation is more specific and the ratio of large thinning flakes drops as the piece gets thinner. In order to remove larger flakes from the dorsal surface, more effort goes into preparing striking platforms that can withstand a significant blow without the mass of the piece to support the platform. This is done by grinding and abrading to strengthen the striking platform, weakening the edges adjacent to the platform by removing mass, and aligning arrises behind the platform for

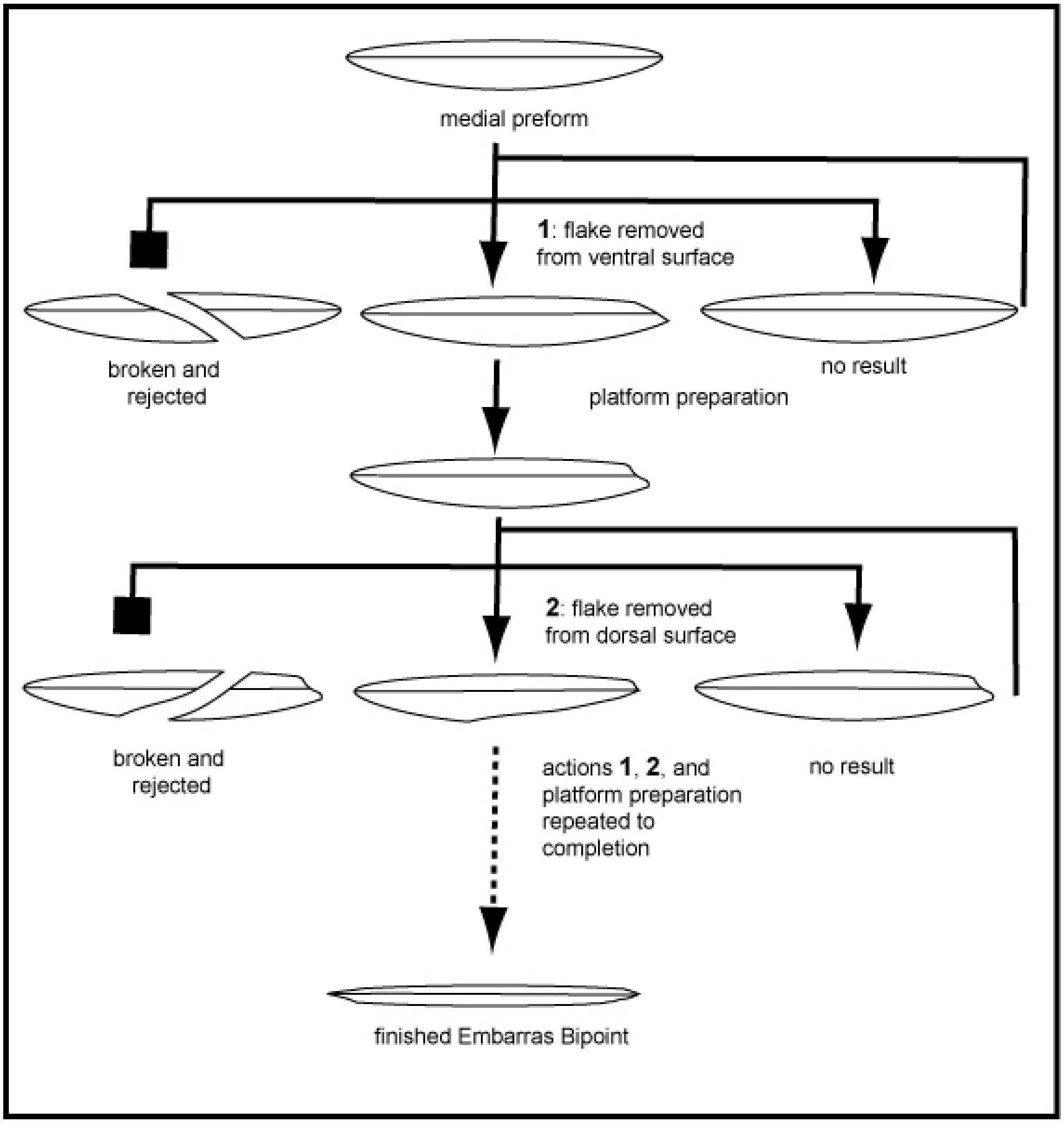

Figure 7.7: The Chaîne Opératoire of a Completed Embarras Bipoint

bulk and as guides for the flake. The ratio of large thinning flakes does drop when compared to the medial stage thinning flakes. Yet, so does the overall size of the piece being worked so, in fact, they are proportionally similar in size to medial stage thinning flakes. Another difference is there is a greater chance for the piece to fail as the piece gets closer to being completed. The last difference between the chaîne opératoire for the tertiary stage and the medial stage of reduction is a definite decrease in the amount of cortex found on flakes from the dorsal surface.

The number of actions involved in the tertiary stage chaîne opératoire depends on where along the entire reduction sequence the piece was completed to a preform state. For these experiment there was on average of thirty to forty actions at the tertiary stage of reduction. These actions include removing large thinning flakes from the dorsal surface, shaping and platform preparation flakes from the dorsal surface, shaping flakes on the ventral surface, some thinning flakes from the ventral surface, edge dropping flakes from the ventral surface, and platform preparation flakes from the ventral surface.

7.6.6. Archaeological Examples

For a complete listing of known Embarras Bipoints see Table A.1. in Appendix A. Plates 1 to 20 are the Embarras Bipoints used in this thesis. A more in depth discussion of these tools can be found in Chapter four and in Appendix B.

7.6.7. Discussion

One of the interesting observations arising from the failed pieces was that many of the fracture patterns were caused by bending. There are two plausible explanations for this occurrence. This first is that the integrity of the material is disproportional when the width is compared to its thickness thus creating a hierarchical way a piece will break. In other words, the energy introduced by the dynamic load will fracture as expected by detaching a flake then either through the shorter distance which is the thickness or with enough energy through the width of the specimen. Obviously, there are other variables which influence how a specimen breaks with a bending fracture but they have been purposely excluded. The second more plausible explanation is that fractures were caused by the piece not being held appropriately. When the dynamic load transferred the energy into the piece, the momentum of the billet, and the flex of my holding position made the specimen twist, creating a perverse fracture.

Another interesting observation that was made during this stage of the experimentation was that indirect percussion might have greatly increased my chances of successfully completing a piece. The accuracy of the punch and the dynamic load of a billet or hammerstone could have allowed for longer thinner flakes to be removed. One variation of the indirect percussion technique is the rocker punch technique. This involves placing the punch on a secure surface, like my leg, then putting the punch on the desired striking platform which is also placed against a secure surface (i.e. my leg). The end of the punch directly above the striking platform is then struck with a percussor. The punch and the secure surface in conjunction with the dynamic load transfer act as a lever and not only push directly down on the striking platform but pull the striking platform away from the piece in an arc. The successful completion of this technique does require a high level of skill and patience but the resultant detritus is generally large, wide, thin flakes that are characteristic of those struck from Embarras Bipoints.

As a modern flintknapper with no experience of having to rely on functional stone tool, I have the tendency to strive for aesthetic tools rather than functional tools. For these experiments I purposefully tried to change this perspective by striving to make tools that could be used, regardless of aesthetics. All of the pieces that were finished into completed tools had clean sharp lateral, proximal and distal edges. However, the compulsion to produce aesthetically-designed tools often marred the satisfaction of completing a specimen.

Another observation that was made from this stage of the experiments was of the production of large comedial thinning flakes that could be used as expedient tools. The expectation had been that most of the large thinning flakes that could be used as short term tools would have been produced during the medial stage of reduction. However, in some case I was still able to produce flakes that were greater than 8 cm in length. These types of flakes did not occur as often as in the medial stage of reduction but frequently enough to be noteworthy.

7.7. General Observations from all Three Stages of the Experiments

There are a number of observations made from the experimental work and analyses of Embarras Bipoints that did not fit within the four elements of an action, but which warrant further discussion. The following section is a discussion of these observations and what they may mean to the interpretation value of Embarras Bipoints.

7.7.1. Attribute Analysis

One important element of any lithic study should be attribute analysis. What is attribute analysis? When a stone tool is being made there are physical attributes both on the tool and the resultant debitage that convey information about each action throughout the chaîne opératoire. This approach is very common to most lithic analysis. One unique aspect of this study was the focus on the morphological attributes as they related to other attributes on the same artifact, as well as other artifacts, rather than on any metric or numerical relationship. Examples of metric and numerical attribute analysis would be, counting the number of flake scars on the platform (i.e. Magne 1985), or the neck width of a projectile point determines projectile type (Peck and Sinkey 2000).

Instead the attribute analysis used in this thesis looked at the similar artifacts and placed them into the chaîne opératoire by comparing the configuration of attributes on the artifacts. Some of the attributes, for example, were of the platform and how it related to the dorsal scarring, material type, longitudinal cross section, lipping, amount of cortex, and so on. This type of attribute analysis takes a more holistic approach. This approach is more useful in many ways because it can compensate for anomalies on a flake. For example, if a flake has four or more flake scars on the platform and evidence of grinding, but the dorsal surface is almost all cortex, according to some metric or numerical based analysis (i.e. Magne 1985) this flake would fall into two different flakes catagories. A more holistic attribute analysis takes the same flake and recognizes that a complex striking platform, found on late stage flakes, can still exhibit attributes consistent with early stage reduction.

Are there morphological attributes that can be more informative? Using a metric-numerical analysis, the answer is yes. The number of flake scars on the platform does corroborate the stage of reduction and, therefore can be more informative that other morphological attributes on the flake. Another example would be the width, and depth of a notch which can be indicative of projectile point style or type but not to the exclusion of all the other attributes of a projectile point. A more holistic approach does not appoint a hierarchical relationship to any of the attributes. Instead all morphological features are treated equally and as interconnected phenomenon, since each stone artifact is unique.

If there is no hierarchical arrangement of artifact attributes, Bonnichsen (1977:179) states it best when he writes, “how [does one] observe or select attributes on prehistoric artifacts which reflect decisions on the part of the lithic craftsman[sic] who made the tool”. The best approach is not to overwhelm the analysis by trying to look at all the morphological features of an artifact or conversely not looking at enough to make the analysis meaningful. One personal observation from the experiment and analysis of the tools and their debitage is that there needs to be a level of flexibility that allows for the evolution of ideas about the importance of attributes.

7.7.2. Striking Platforms

Now, to be contradictory, any lithic analysis would be negligent not to recognize the importance of the striking platform on debitage. Following the argument discussed in the previous section, a holistic attribute analysis makes no one feature or element of the platform more important than another. Ergo, a striking platform is the amalgamation of all its traits and can be compared to the amalgamation of traits on other striking platforms. For example, the striking platform on a 'classic' biface reduction flake has the scarring, lateral edge and/or proximal edge grinding, crushing, use-wear, lipping, as well as shape and size that are equally important. Each of these traits on the platform has to be considered when comparing the striking platforms of flakes. The more platform traits in common that flakes have, the greater the chance that they were produced in a similar fashion.

One issue that was a problem during the experiments and the debitage analysis was crushed and/or collapsed platforms. Bonnichsen (1977:164) believed that, "soft impactors never lead to crushing, microflaking, and microcracking in quartzite materials". Yet, the experiments showed that flaking quartzite does create crushed and collapsed platforms which can obliterate or remove most, if not almost all, of a platform, making any interpretation difficult. Nevertheless, the flexibility of a holistic attribute analysis allows for missing or confusing attributes, like a collapsed or crushed platform, because one can still use the remaining flake attributes to determine its type. The down side of this is that with traits missing or obscured there is a greater chance of misidentifying flake types. However, experience and patience greatly increases the chances of properly identifying most flakes.

The attributes, in no particular order of importance, which were used most often in this analysis included; platform size shape and scarring, dorsal scarring, dorsal shape, flake size (length, width, and thickness), refits, dorsal scar sequencing, toolstone colour and texture, percent of cortex, flake cross section (transverse and longitudinal), and lipping.

7.7.3. Technological Patterning

One way to elucidate the similarities between actions is to group like actions, based on the results of the actions, into attribute clusters (Bonnichsen 1977:64). This can be based on a single morphological attribute recurring in a series of actions or on a range of attributes repeated in a series of actions. The more actions that can be attributed to a cluster the greater the significance of the cluster; the significance being that these clusters or segments within the chaîne opératoire are repetitive patterns which implies behaviour and behaviour is agency. The identifiable flake types for Embarras Bipoints have been discussed in the medial stage experiment section.

Another way to construct attribute clusters or segments within a chaîne opératoire is by refitting. Refitting is taking like artifacts and physically put them together in the sequence they were removed. One objective, initially, was to reconstruct a chaîne opératoire with a heavy reliance upon refitting. This would have provided the greatest amount of data on the reduction sequence of Embarras Bipoints. After considering all the variables, the reality of such a venture was realized to be nearly impossible. This would require having an archaeological data set that had a complete reduction sequence, including discarded tools. An alternative to trying to reconstruct the entire chaîne opératoire was to focus on definable segments of the chaîne opératoire; for example, the splitting of a cobble or the last series of flakes taken off the dorsal surface. Every effort was taken to find conjoined artifacts in the archaeological data set. Unfortunately, the number of artifacts that could be refitted was so small, they proved to be meaningless. However, I still believe with more time and effort and a greater attention to the smaller, less obvious details a refitting program would have provided a more thorough analysis than presented in this thesis.

7.7.4. Tertiary Stage Pressure Flaking

From the examination of the lithic assemblages from FgQf-16 and a number of other sites, there is little evidence of small tertiary flakes. The reason is there was little need for pressure flaking. My impression is that Embarras Bipoints were made predominantly, almost exclusively, with percussion flaking. This is because, except for extremely fine-grained varieties, quartzite is not an easy material to pressure flake. If the pressure flaking technique produces insignificant or insufficient results, then a greater reliance would have to be placed upon the dynamic reductive techniques. An alternative theory would be there are sampling biases created by the way artifacts are recovered (i.e. in 5mm mesh screens). This will be discussed in greater detail in the future work with the materials from FgQf-16 (Meyer and Roe n.d.).

7.7.5. Edge Bite Platforms

One distinguishable trait of most Embarras Bipoints is sinuous lateral edges associated with large percussion flake scarring on the dorsal surfaces. There are a number of plausible explanations for these morphological characteristics, but the best explanation is they are the result of flakes being removed with edge bite platforms. As each flake, with an edge bite or a similarly typed platform, is bifacially detached along a lateral edge, a snake-like or sinuous appearance is created, as seen in the longitudinal profile. The most common way to produce an edge bite platform is by soft hammer percussion but it can be done to some degree with pressure and on occasion with hard hammer percussion. There are two ways an edge bite platform can occur. One results when the striking platform was over prepared and as a consequence too sturdy. So, in order for the flake to initiate, it travels into the body to a point where the energy exceeds the critical threshold of the toolstone creating the characteristic edge bite platform. The other is that too much of the lateral edge on either side of the striking area is prepared, meaning the fracture has to initiate in from the edge rather than on the edge. This distinct flake type is generally considered to be fortuitous (Whittaker 1994:190). However, the occurrence of sinuous lateral edges on Embarras Bipoints and the high number of recovered flakes with edge bite platforms, both from the archaeological data set and the experimental work, has led me to believe they were intentionally produced.

An edge bite flake has been defined by Whittaker as "thin and flat, an ordinary biface thinning flake but with an exaggerated lip. The initiating fracture was not near the point where the hammer struck the platform (the edge of the biface), but even further in than usual. […], the platform on the edge is made too strong to allow a fracture to start there, or the blow falls too far from the edge" (1994:190). Another explanation for an edge bite platform is that bending forces have initiated the flake. Cotterell and Kamminga (1987:690) describe bending initiations that in exaggerated cases would be edge bite platforms as,

> the initiation face of the nucleus that forms the proximal end of the bending flake is segment shaped and a neat concave scar is left on the initiation face. In the formation of a bending initiation, the crack begins at a flaw in or near the initiation face [but can initiate further into the body] and grows downward at an angle of 90%. If the edge angle of the nucleus is relatively large-say, greater than about 45[degrees]- the crack will curve out so that it runs approximately parallel to the side face of the nucleus… Bending initiations do not have a bulb of force, though the flake surface created during the

transition from initiation to propagation can look superficially like a diffuse bulb.

Lastly, Crabtree defines bending flakes, which can have edge bite platforms as, "hav[ing] pronounced curves on the plane of fracture. They leave scars on the artifacts [the platform], which extend from one lateral margin towards the opposite edge and pass the median line. They are commonly diagonal" (Crabtree 1982:16). This can be interpreted as a platform that extends from one lateral edge to the other and has a width greater than the centre line of the lateral edge. As with so many things, a picture is worth a million words. Figure 7.8 is a three way view of a typical edge bite flake (Crabtree 1982:44).

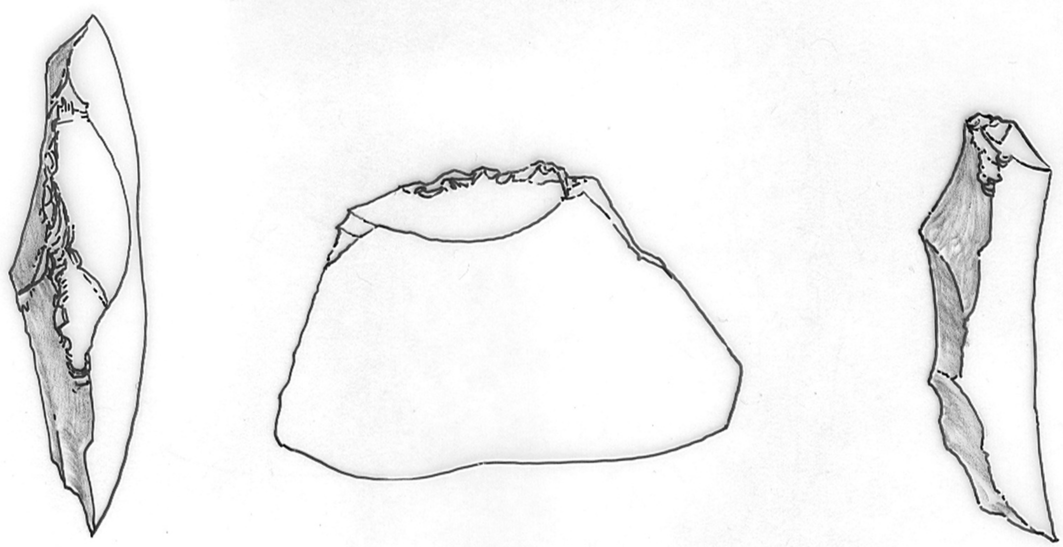

Figure 7.8: An Example of a Flake with an Edge Bite Platform

Why are edge bite platforms and sinuous lateral edges characteristic traits of Embarras Bipoints? One explanation is that the makers of Embarras Bipoints, with a quartzite medium, were striving to produce large, mass removing flakes which require a sturdy striking platform. If a striking platform is too strong, the energy transferred from the percussor to the stone will travel into the stone to a point where the compressive and tensile strengths are weaker. From using quartzite in the experiments, it became obvious an under prepared striking platform, in most cases, would crush or collapse without removal of a flake when hit with a percussor. The goal was to make sure the striking platform was strong enough to withstand the dynamic transfer from the billet into the piece. This sometimes resulted in the over preparation of the striking platforms, which would result in flakes with edge bite striking platforms.

Another explanation for edge bite striking platforms is the degree of isolation of the striking platform in relation the rest of the lateral edge (See Figure 7.9). One of the ways to assist the chances of producing large thinning flake in quartzite is to prepare a sturdy, asymmetric, biconvex striking platform, in other words, isolate the striking platform. In order for this to happen, a number of variables need to be considered. In planview, and before being detached from the preform, the striking platform can be completely, partially, or not isolated. The platform has to be clean with no projections, steps, and/or stacks. The swing has to be harder when using quartzite than for other toolstone, and very accurate. Although quartzite is a temperamental material, there is a bit of forgiveness in the material but the window is relatively restrictive when compared to other tougher materials. A percussive swing that is even a little off the mark will often result in crushing the striking platform and or the lateral edge, creating stacking on the body, step fractures, and other fortuitous results which can ruin or hinder further work on the piece. The striking platform has to be aligned with arrises on the face of the stone so that the flake does not fan out, but travels into the body of the preform.

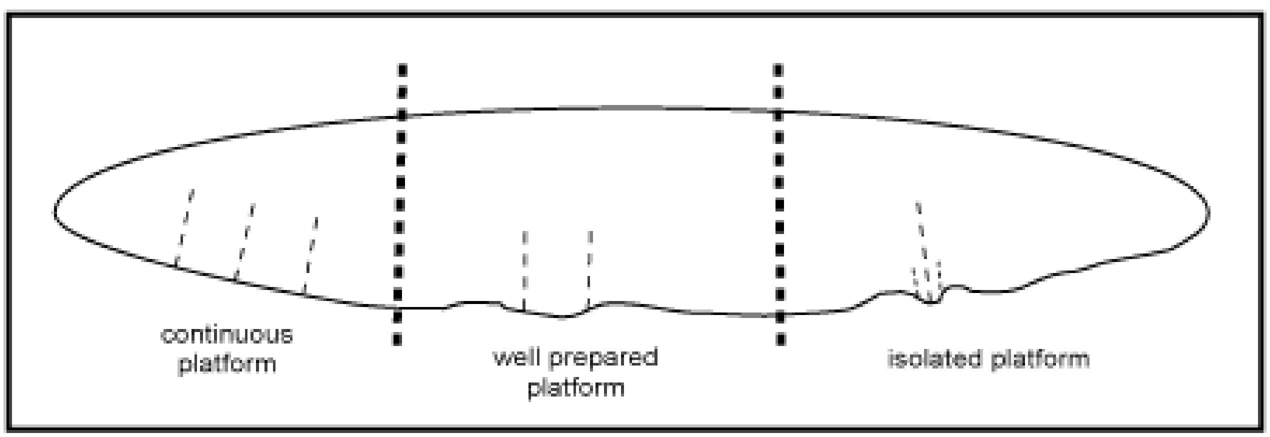

Figure 7.9: Example of Different Striking Platform in Planview

Were the makers of Embarras Bipoints isolating their striking platforms? In a sense, an edge bite platform is a form or type of isolated platform. The question becomes one of whether these platform types were planned, accidental or an inevitable consequence of working with quartzite. On the contrary, a true isolated platform (a good illustrated version can be found in Patten (1999:81) would remove less body width than an edge bite platform, which is not the case with Embarras Bipoints. Furthermore, the platforms were not isolated in the 'classic Clovis' sense but there does appear to have been a significant percentage of semi-isolated platforms which resulted in edge bite platforms. In the FgQf-16 lithic assemblage and the debitage produced in the experiments, there were numerous examples of edge bite striking platforms that were semi-isolated. So, to answer the question of, were platforms isolated during the production of Embarras Bipoint? The answer at this stage would have to be - possibly. Further work on Embarras Bipoints and the lithic technology of the Early Middle Period will have to be conducted before a more definitive answer can be offorded.

Another observation about edge bite flakes that arose from during the experiments was that, at first, I believed there was a remnant platform, from the initial spall, on either the proximal or distal ends of most Embarras Bipoints. However, with further analysis of the tools and the types of flakes found in conjunction with Embarras Bipoints I found a better explanation for this morphological feature. The presence and use of edge bite striking platforms to manufacture Embarras Bipoints does explain the remnant platform found on or near the proximal or distal end of the tool. For example, a portion of a lateral edge or the entire edge is prepared for removing a series of large thinning flakes. After the flakes have been removed there may be portions of the prepared edge left on the lateral edge with the mass behind the edge and into the body being removed, creating the appearance of a remnant platform.

7.7.6. The other flakes types associated with Embarras Bipoints

There are three more types of debitage, not discussed in the medial stage experiments, that are could be related to the tertiary stage production of Embarras Bipoints. The removal of larger soft hammer percussion flakes, possibly with cortex, would definitely be one flake type. The amount of cortex would diminish as the chaîne opératoire progressed. Another would be smaller, prepatory, fan-like flakes, possibly with small step stacks near the proximal end, from the removal of material from the ventral surface. The third would be small, thin flakes with heavily rounded platforms with small step stack features near the striking platform on the dorsal side from the thinning of over prepared striking platforms. Obviously, from the production of any stone tool there will be a wide assortment of debitage and the production of Embarras Bipoints will be no different.

7.7.7. Dorsal to Ventral Flake Ratio

One of the strongest diagnostic characteristics of Embarras Bipoint is the extensive flaking on the dorsal surface when compared to the ventral surface. This technological trend may be a very useful way of determining if a biface is an Embarras Bipoint. The formula is very simple. Count the flakes on the dorsal surface that are greater than one-third the maximum width of the tool and then count the flakes on the ventral surface of the same size. The number of flakes on the dorsal side can be compared to the number of flakes on the ventral side in a ratio format. An illustrated example can be seen in Figure 7.10. Why one-third the maximum width and not some other measurement? In the operational sequence of most bifacially worked stone tools there are many actions. The vast majority of those actions, such as platform preparation, realignment of a lateral edge or moving a striking platform in line with arrises, result in a lot of small debitage. The larger flakes, like thinning and sometimes shaping flakes, account for only a small portion of the total actions. Establishing a measurement of one third the maximum width removes most of the smaller flakes but accounts for the larger flakes. This measurement is relative and can be adjusted to suit the length and width dimensions of the tools being analyzed as long as the measurement is consistent for each tool.

The average dorsal to ventral flaking ratio for the complete Embarras Bipoints is just over two to one (2.2:1) (See Table 4.1). Although the archaeological sample size is small (N=25), each of the tools exhibited a greater number of flakes on the dorsal surface as compared to the ventral surface. The greatest variation was over three and a half to one (3.7:1), but I believe this tool was unfinished and its ratio would have been different if completed. The least variation was less than one and a half to one (1.25:1) which is close to a 1:1 ratio but still different enough to be distinct. Therefore, an average ratio of just over two to one (2.2:1) is a strong characteristic of Embarras Bipoints. Yet, as mentioned in Chapter four Embarras Bipoints are, “polythetic” tools (Andrefsky 1998:65), and the dorsal to ventral flaking ratio should be used in conjunction with the other technological and morphological markers to determine if a stone tool is an Embarras Bipoint.

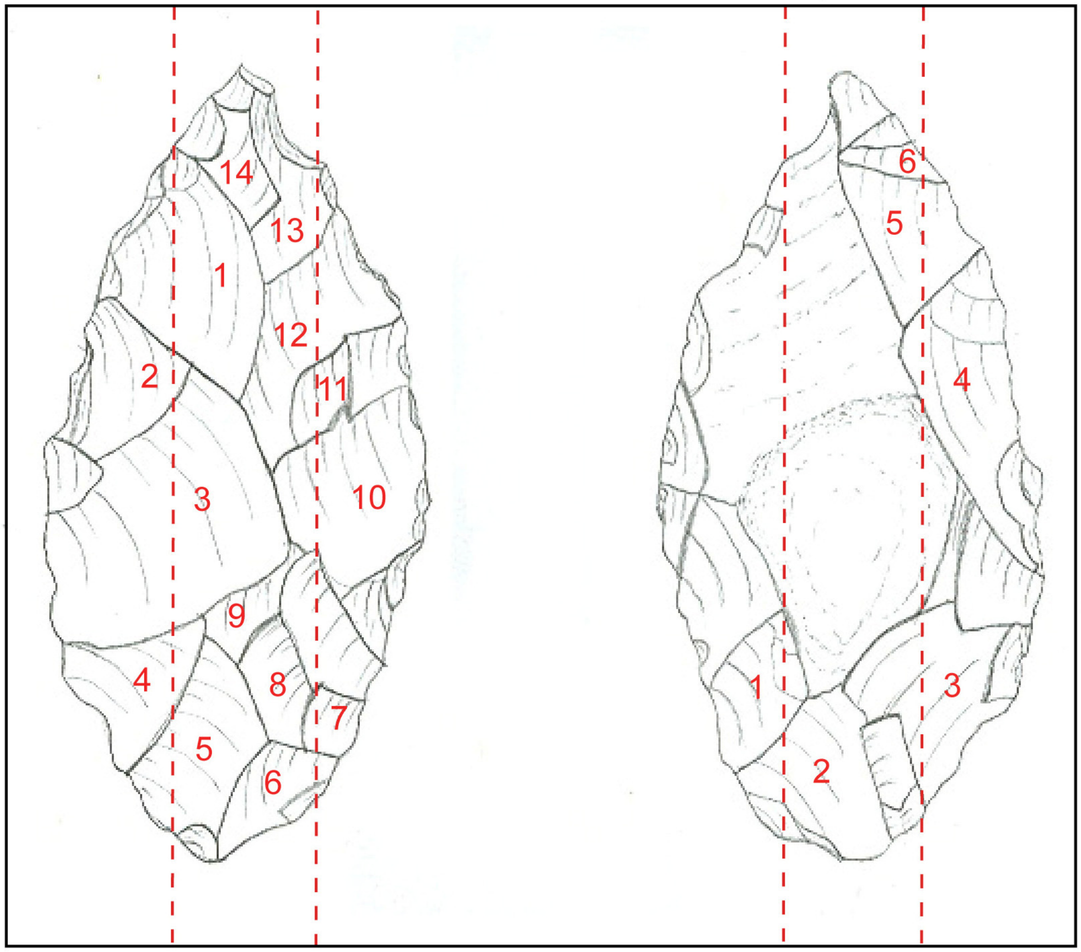

Figure 7.10: Dorsal to Ventral Flaking Ratio

7.7.8. Minimum Effort for Maximum Results

Another observation I made from the experiments can be called the 'the minimum effort for maximum results' perspective. One of my personal flaws as a stone tool maker is I will strive to produce the thinnest, most symmetrical tools possible at the expense of losing a tool's functionability. All of the Embarras Bipoints I have observed are some of the better made stone tools but they are not always as thin or as symmetrical as I would have tried to make them. This has to be because I am not using them for their intended purpose. If I were to incorporate them into my daily life, there would be less concern with their aesthetic qualities and more with their functionability as tools. So for the experiments, as long as each of the bifaces met all the criteria to be functional then their thinness or symmetry became secondary.

It appears the idea of 'minimum effort for maximum results' was a behavioural trait of Embarras Bipoint makers. Why expend the effort when a less complex method or process works just as well? If a piece can be effectively thinned, shaped and be ready for use in ten actions, then why do more (say fifteen or twenty action)? This approach is not indolent; this is a very logical approach. If a tool has sharp edges, has the right cross section, the right shape, why put in the time and effort that could be used elsewhere, to 'perfect' an already perfect piece.

7.7.9. Success Rate

One way to look at the success of this experiment would be to count the number of pieces that were completed to finished tools. This way of determining the success of the experiment should not be taken. When a specimen 'failed', the piece was not worked any further and considered finished. The data from that specimen was not discarded but treated in the same fashion as the pieces that were finished into Embarras Bipoint. These interrupted experiments were studied and used as examples of problems that could have been encountered by the original makers of Embarras Bipoints. These problems could then be addressed and analyzed to further improve the chaîne opératoire of the next piece to be worked. For example, why did the piece fail? What could be done to resolve that failure? What types of similar problems are seen on the archaeological examples? Did the technological sequence leading up to the failure differ than those for the completed Embarras Bipoints? Is this a reoccurring problem in the reduction sequence?

7.7.10. Fracture Pattern of Broken Embarras Bipoints

The way the original Embarras Bipoints were broken could be indicative of their use. The three main types of fractures found on broken Embarras Bipoints were snap, perverse, and radial fractures. How and why Embarras Bipoints were used, which has been briefly discussed elsewhere in this thesis, is a very interesting question that does deserve further exploration.

There were a variety of fracture patterns that occurred during the tertiary stage experiments. Two of the more interesting examples include perverse (Figure 7.11) and radial fractures. For examples, from the experiments, of perverse fracturing see specimens 35-A and 39-A. A perverse fracture is generally the result of inappropriate holding of the specimen, causing the energy to bend or twist rather than fracture the piece.

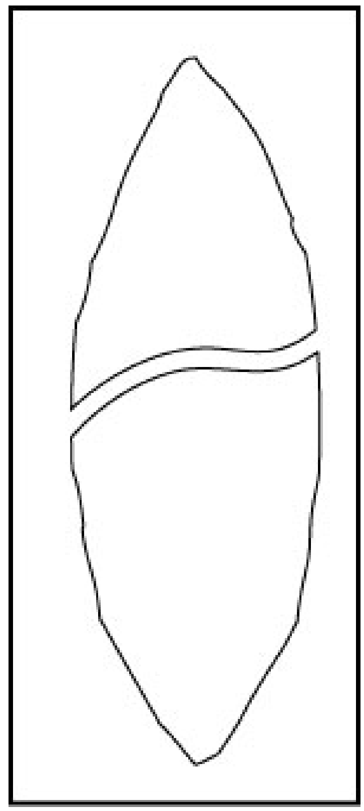

Figure 7.11: Example of Perverse Fracture in Planview

There were a number of perverse fractures found in the archaeological data set (For example FgQf-131-1, FgQf-143-1, FgQf-16-100, 1001, and 1034, FgQg-17-6, FQf-10 45, 1065, and 1082, and FhQg-2-609). A perverse fracture could also result from using the tool in a twisting or bending manner. The question becomes, were the archaeological specimens with perverse fracture broken during the manufacturing process or are these breaks the result of their use. This question cannot be answered at this point and will require further investigation.

Another common fracture type found on a number of archaeological examples were radial fractures (for example FgQe-56-1, FgQf-16-1013, FhQf-10-978, FjQk-7-1, FkQj-11-32, and FkQj-17-7). A radial fracture can be caused by a perpendicular impact to the body of the piece causing more than one fracture to initiate that radiates out from that point (Figure 7.12). A Hertztian cone may be created with this type of fracture.

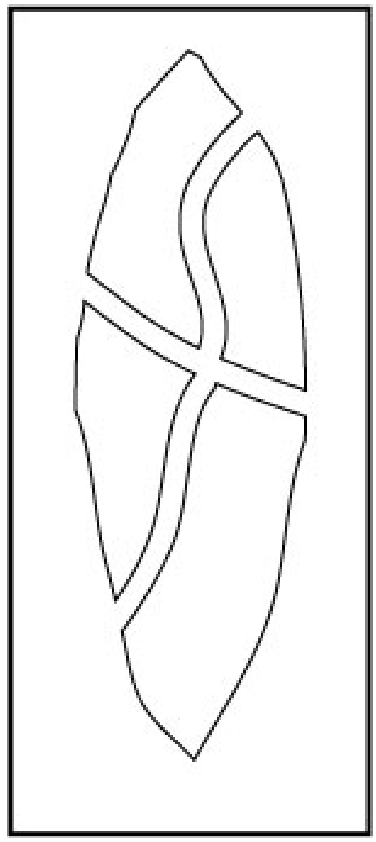

Figure 7.12: Example of Radial Fracture in Planview

The interesting question is why or how did a number of the archaeological specimens end up with radial fractures? One possible answer is they were intentionally broken, but the question then becomes why were they intentionally broken in this manner? To answer this question would require a whole new thesis.

7.8. Concluding Remarks

The intent of this chapter has been to provide a synopsis of the results of the experiments and to show that Embarras Bipoints have unique technological and morphological traits. The format used to present this data was based upon the four elements of an action (Lemonnier 1986:152). The four elements of an action are material type, tools used, action, and specific knowledge. The information for each element was presented in a generalized format so as too encompass each stage of the experimental process, but with specific data when necessary.

Chapter 8
Summary

Lately it occurs to me: What a long, strange trip it's been.
(The Grateful Dead)

8.1 Introduction

This has been a technological analysis of Embarras Bipoints. On a broader level, this has been a study of stone tool technology of the Early Middle Period, particularly along the Eastern Slopes of Alberta. As a technological study, I have purposefully avoided the reliance on metric attributes and overall form so that the chaîne opératoire became the focus and was not adjunctive. Some may disagree with this approach, but I feel the chaîne opératoire approach allowed me the opportunity to approach the study of Embarras Bipoints as an anthropologist of techniques rather than as an etic analyst relying on metrics and statistic for answers.

8.2. The Chaîne Opératoire of Embarras Bipoints

Based upon the replication and analysis of the artifacts, the reduction sequence for making Embarras Bipoints must have been fairly consistent. The overall pattern of more intense flaking on the dorsal surface, with 'pointed' proximal and distal ends, and use of locally derived quartzite, appears to be characteristics of these tools. Other attributes include bi-convex or plano-convex transverse cross sections, wavy lateral edges, the potential for cortex on the dorsal surface, and a large overall size. The replication of over forty Embarras Bipoints (including broken pieces), following these basic guidelines, showed that not only could a specific chaîne opératoire be followed but it could be applied consistently. I fully recognize the potential for other chaîne opératoires that could have produced similar results. However, because I believe in the consistency of my results I make no apologize for sticking to the operational sequence I followed.

Some of the changes I could make to improve the chaîne opératoire would include more tools being made, using a wider variety of flintknapping tools, and more focused attention on individual actions as they related to previous and following actions.

8.3. Diagnostic Characteristics of the Embarras Bipoint

The four main characteristics that make Embarras Bipoints unique are their size, shape, material type and flaking pattern. The size of these tools ranges from 5 cm to 14 cm in length with a width from 3 cm to almost 9 cm. When compared to most stone tools, Embarras Bipoints are consistently on the larger side. There is a range of shapes an Embarras Bipoint can have, from elliptical to almost rectangular, but there is always a 'pointed' appearance to the tool. The transverse cross section of these tools ranges from plano-convex to bi-convex, with the lateral edge being on or above the transverse median towards the dorsal side. The most common, almost exclusive, toolstone used for Embarras Bipoints is higher quality, fine-grained quartzite. The dominant colour of these quartzites is various shades of grey. Greens, reds, and yellows also occur. I believe the toolstone played an important role in the use of these tools. Possibly, quartzite was consistently chosen because, although less sharp than other toolstones, the edge could be used for longer periods of time before having to be rejuvenated. Regardless of the size, shape, and toolstone, the chaîne opératoire that was used to manufacture these tools is by far the most important, and ultimately diagnostic, trait of the Embarras Bipoint. A split cobble worked almost exclusively on the dorsal surface with platform preparation, and some thinning and shaping on the ventral surface are the hallmarks of the chaîne opératoire. To be more polythetic, the four main characteristics of these tools are all important and to make the best identification possible each trait should be considered before determining if a tool is an Embarras Bipoint.

8.4. Embarras Bipoints and the Early Middle Period

As mentioned in Chapter three there does appear to be the preliminary data for the development of the Embarras Sub-Phase (ca. 7,000-4,000 years B.P.) of the Mummy Cave Complex in the Foothills Region centred on the town of Hinton (Meyer and Roe 2008a). The characteristics of this sub-phase include the use of larger formalized stone tools, i.e. Embarras

Bipoints, made from local toolstone. The projectile points have tentatively been identified as Embarras Side-Notched, a localized type within the Mummy Cave Complex. There is a regular incidence of large unidirectional split cobble cores and smaller bipolar cores. There does not appear to be a standard occurrence of smaller formal tools such as end scrapers while fire cracked rock and related technologies appear to be absent.

Commonly found in the debitage are specific flake types such as large thinning flakes with edge-bite striking platforms. Another common flake type is smaller and is the detritus produced by dropping the lateral edge below the centre-line in cross section. Dorsal cortex on large thinning flakes is another common trait found in debitage assemblages. The occurrence of large split cobbles and/or large shatter would be indicative of the early stages of reduction. One could argue the presence of anvil stones and large hammerstones could be indicative of the early stages of reduction for Embarras Bipoints and the other large formalized tools of the Embarras sub-Phase.

The Foothills is the core area for the Embarras Sub-Phase, with a particular focus on more open environments suitable for bison and other large ungulates. This does not preclude the possibility of a wider geographical range for the Embarras Sub-Phase. Only when more work is done, not only with Embarras Bipoints but other assemblages from the Early Middle Period, will the opportunity arise to make more definitive statements about this unique and interesting period of time.

8.5. Future Work to be done with Embarras Bipoints

I predict that future work with Early Middle Period tool assemblages will show that most if not all the large formalized stone tools (i.e. Embarras Bipoints, Reverse Unifaces, Lovett Unifaces, Erith Knives, etc.) will have a collective chaîne opératoire that will reflect a technological expression of the Early Middle Period. A technological expression for example would be the fluting techniques and platform isolation of Clovis technology. The differences between these formalized tools will be obvious, like reversing the intensity of flaking on Reverse Unifaces versus Lovett Unifaces, distinct proximal and distal ends on Erith Knives, and the overall shape, and intended use for each of these tools.

Another interesting study of Embarras Bipoints and how these tools were used would be to measure all of the debitage pieces that have 5 cm long edges, or some other predetermined measurement, to determine the overall working edge an Embarras Bipoint produces throughout its use-life. This would also include measuring the cutting edge on the Embarras Bipoint after an edge has been completely resharpened. A study of this kind could show that as a multipurpose core tool, the Embarras Bipoint not only had two functional edges but was also able to provide 'X' amount of working edge from the debitage being produced.

One relatively common type of archaeological site in the Hinton area is small, but dense, one-time lithic workshops. The assessment, excavation, analysis, and interpretation of a representative sample of these might prove fruitful for fleshing out the lithic technology used in this area. The reasons a study of this type would be fruitful is there is a greater chance for debitage and tool refits, flintknapping tools (such as hammerstones and anvils), toolstone homogeneity, rejected spalls, unfinished tools, more individualistic flaking traits, and specific scatter patterns. Other reasons this type of study would be useful is there would be a high concentration of debitage from one reductive event, discarded preforms not worth rejuvenation, and the chance to see a flintknapper's organizational patterning.

The most obvious study that needs to be done with Embarras Bipoints is a thorough use-wear analysis. Some blood residue analysis has been done to tell us the animal species these tools were used on. A use-wear analysis would definitely provide some insight as to what types of activities were undertaken and how those activities relate to results of blood residue analysis. Included in a use-wear analysis would be the study of how these tools were broken. This topic was touched on in Chapter 7 but a more thorough analysis is needed. Did the Embarras Bipoints with radial fractures break through use or was there some other less obvious activity, for example ceremonial, being done with these tools that produced this type of break? Are the perverse fractures a result of a flaw in the toolstone, a mistake during the reduction sequence, or a result of use? Answers to these types of questions would go a long way to bettering our understanding of Embarras Bipoints and the role they played in Early Middle Period life.

8.6. Conclusion

The purpose of this thesis has been to show that with a chaîne opératoire approach and replication it can be demonstrated that *the Embarras Bipoint is, in fact, a diagnostic tool of the Early Middle Period*. To meet this end I replicated over forty specimens, provided a representative sample of archaeological examples of both Embarras Bipoints and other tools, and provided a simple but relevant chain of events these tools could pass through from a raw state to a finished state.

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Appendix A: Tables

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete/ Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Dorsal to Ventral Ratio	Fracture Pattern	Plate	Reference
DgPl-85	n/a	Alberta		Bitterroot point	quartzite	complete	100	47	8	n/a	n/a	complete	Plate 17	Reeves 1972:79-80,181,446
DjPp-2	n/a	Alberta		Early Middle Period points	quartzite	complete	85	38	8	n/a	n/a	complete	no picture	Reeves 1974:36,49, 64
EgPm-179	1437	Alberta	Hawkwood Site	Early Middle points	quartzite	complete	141	45	12	bi-convex	2.5:1	complete	Plate 8	Van Dyke and Stewart 1985:26,137, 218
EgPr-2	362	Alberta	Sibbald Flats Site	Oxbow, Mt. Albion points	quartzite	broken	52	50	n/a	n/a	n/a	radial	Plate 17	Gryba 1983: 70-76
EgPr-2	1035	Alberta	Sibbald Flats Site	Oxbow, Mt. Albion points	quartzite	broken	45	42	n/a	n/a	n/a	perverse	Plate 17	Gryba 1983: 70-76
EgPr-2	5856	Alberta	Sibbald Flats Site	Oxbow, Mt. Albion points	quartzite	complete	90	45	16	n/a	n/a	complete	Plate 17	Gryba 1983: 70-76
EgPr-2	6072	Alberta	Sibbald Flats Site	Oxbow, Mt. Albion points	quartzite	broken	85	49	10	n/a	n/a	snap	Plate 17	Gryba 1983: 70-76
EhPu-1		Alberta	Lake Minnewanka Site	Bitterroot point	quartzite	complete	90	35	n/a	n/a	n/a	complete	no picture	McIntyre and Reeves 1975:pl 11,6
FfQm-26	191R 1A2-8	Alberta	The Patricia Lake Site	Large Side Notched point	light grey quartzite	complete	99	47	18	n/a	n/a	complete	no picture	Pickard 1985:16-17
FgQe-14	4107	Alberta		Reverse Unifaces, Lovett Unifaces, Early Middle Period points	green quartzite	broken (<50%)	33	31	10	bi-convex	n/a	snap	Plate 11	Calder and Reeves 1977:10-12, 32, 43
FgQe-16	289	Alberta		unnotched Oxbow point, Lovett Uniface	grey fine-grained quartzite	complete	128	50	9	bi-convex	1.75:1	complete	Plate 1	Calder and Reeves 1977:12-13, 32, 43
FgQe-56	1	Alberta		n/a	pink fine-grained quartzite	broken (<50%)	44	67	16	plano-convex	n/a	radial	Plate 11	Meyer 2003:418,424
FgQf-131	1	Alberta		n/a	blue/grey fine- grained quartzite	broken (>50%)	63	50	16	bi-convex	n/a	perverse	Plate 12	Meyer 2003:418,423
FgQf-131	3	Alberta		n/a	light grey fine- grained quartzite	broken (50%)	51	41	9	plano-convex	n/a	snap	Plate 12	Meyer 2003:416,425-426
FgQf-141	26	Alberta		n/a	light grey fine- grained quartzite	broken (80%)	90	58	17	plano-convex	n/a	snap	Plate 12	Meyer 2004:455, 460

Table A.1: Complete List of Known Embarras Bipoints

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete/ Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Dorsal to Ventral Ratio	Fracture Pattern	Plate	Reference
FgQf-141	27	Alberta		n/a	light grey fine-grained quartzite	broken (<50%)	43	46	11	plano-convex	n/a	snap	Plate 11	Meyer 2004:455, 463
FgQf-143	1	Alberta		n/a	grey/tan fine-grained quartzite	broken (50%)	43	46	11	bi-convex	n/a	perverse	Plate 12	Meyer 2004:454,463
FgQf-143	4	Alberta		rabbit residue	grey fine-grained quartzite	complete	99	48	9	bi-convex	2.5:1	complete	Plate 2	Meyer 2004:454,460; Meyer 2005:496
FgQf-16	141	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	light blue fine-grained quartzite	complete	130	66	25	bi-convex	1.9:1	complete	Plate 18	Meyer 2003:244, 417,422; Meyer and Roe n.d.
FgQf-16	1000	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	pink fine-grained quartzite	broken (80%)	61	39	12	plano-convex	n/a	perverse	Plate 18	Meyer and roe n.d.
FgQf-16	1001	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	light purple fine- grained quartzite	broken	33	45	12	bi-convex	n/a	snap/perverse	Plate 19	Meyer and roe n.d.
FgQf-16	1013	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	grey fine-grained quartzite	broken (60%)	61	51	11	bi-convex	n/a	radial	Plate 19	Meyer and roe n.d.
FgQf-16	1020	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	green fine-grained quartzite	broken (50%)	52	47	19	plano-convex	n/a	snap/snap	Plate 19	Meyer and roe n.d.
FgQf-16	1034	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	grey fine-grained quartzite	broken	59	65	19	plano-convex	n/a	perverse	Plate 20	Meyer and roe n.d.
FgQf-16	2270	Alberta	Upper Lovett River Campsite	Mummy Cave tools; rabbit, bovine, bear residue	light grey quartzite	broken	48	43	9	plano-convex	n/a	snap	Plate 20	Meyer and roe n.d.
FgQf-180		Alberta	ARESCO site	Early Middle Period point, Lovett Uniface	quartzite	mostly complete	70	50	n/a	n/a	n/a	complete	Plate 10	ARESCO 2006

Table A.1: Complete List of Known Embarras Bipoints

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete/ Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Dorsal to Ventral Ratio	Fracture Pattern	Plate	Reference
FgQf-62	1471	Alberta		rabbit, caribou residue	white fine-grained quartzite	complete	130	67	21	bi-convex	1.83:1	complete	Plate 1	Meyer et al. 2002:81,82, 84, 187-190
FgQf-90	1	Alberta	Coyote Pup Campsite	n/a	dark green quartzite	broken (<50%)	79	31	10	plano-convex	n/a	snap-hinge	Plate 11	Meyer 2003:418, 424
FgQg-17	6	Alberta		n/a	light grey fine- grained quartzite	broken (50%)	46	49	12	bi-convex	n/a	perverse	Plate 13	Meyer 2004:455,463-464
FhQf-10	3	Alberta	Robb sites	Mummy Cave tools	light grey fine- grained quartzite	complete	94	52	11	bi-convex	2.2:1	complete	Plate 2	Hunt 1982:98; Ronaghan and Reeves 1981:I-2, Plate 1
FhQf-10	44	Alberta	Robb sites	Mummy Cave tools	quartzite	broken (50%)	86	68	15	bi-convex	n/a	snap	Plate 13	Hunt 1982:96; Ronaghan and Reeves 1981:I-2, Plate 1
FhQf-10	45	Alberta	Robb sites	Mummy Cave tools	purple fine-grained quartzite	broken (50%)	54	45	9	plano-convex	n/a	perverse	Plate 11	Hunt 1982 :102
FhQf-10	339	Alberta	Robb sites	Mummy Cave tools	dark grey fine- grained quartzite	broken (40%)	34	37	8	bi-convex	n/a	snap-hinge	Plate 13	Hunt 1982:102
FhQf-10	912	Alberta	Robb sites	Mummy Cave tools	light grey fine- grained quartzite	complete	82	58	14	bi-convex	2.0:1	complete	Plate 3	Hunt 1982: table 20
FhQf-10	978	Alberta	Robb sites	Mummy Cave tools	light grey fine- grained quartzite	mostly complete	93	47	15	bi-convex	1.5:1	radial	Plate 3	Hunt 1982:94, 97-98
FhQf-10	1040	Alberta	Robb sites	Mummy Cave tools	grey fine-grained quartzite	complete	89	46	15	bi-convex	1.25:1	complete	Plate 4	Hunt 1982:97-98
FhQf-10	1065	Alberta	Robb Sites	Mummy Cave tools	light green fine- grained quartzite	broken (50%)	45	34	10	bi-convex	n/a	perverse	Plate 12	Hunt 1982:96-97
FhQf-10	1082	Alberta	Robb sites	Mummy Cave tools	light green fine- grained quartzite	broken (50%)	45	64	13	bi-convex	n/a	perverse	Plate 13	Hunt 1982:102
FhQf-10	1210	Alberta	Robb sites	Mummy Cave tools	grey fine-grained quartzite	complete, refitted	103	51	10	plano-convex	2.1:1	snap	Plate 4	Hunt 1982:93
FhQf-10	1261	Alberta	Robb sites	Mummy Cave tools	pink/purple banded fine-grained quartzite	mostly complete	90	47	12	plano-convex	3.0:1	concave snap on lateral edge	Plate 5	Hunt 1982:96

Table A.1: Complete List of Known Embarras Bipoints

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete/ Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Dorsal to Ventral Ratio	Fracture Pattern	Plate	Reference
FhQf-10	1299	Alberta	Robb sites	Mummy Cave tools	grey fine-grained quartzite	broken (60%)	69	42	14	plano-convex	n/a	angled snap	Plate 14	Hunt 1982:93
FhQg-2	608	Alberta		dart point tip	grey fine grained quartzite	refitted, broken (80%)	99	52	11	plano-convex	n/a	snap-hinge	Plate 5	Calder and Reeves 1978:7, 31
FhQg-2	609	Alberta		dart point tip	light grey quartzite	broken (66%)	60	42	13	plano-convex	n/a	perverse	Plate 14	Calder and Reeves 1978:8, 31
FhQg-3	36	Alberta		n/a	grey fine grained quartzite	complete	83	56	10	plano-convex	3.2:1	complete	Plate 6	Meyer 2003:416,426
FiPo-198	n/a	Alberta	Genesse		quartzite	complete	80	30	n/a	bi-convex	n/a	complete	no picture	Ronaghan et al. 1983:10-6, plate 59
FiPo-207	n/a	Alberta	Genesse	Bitterroot point	quartzite	complete	50	20	n/a	bi-convex	n/a	complete	no picture	Ronaghan et al. 1983:10-10, plate 59
FiPo-207	n/a	Alberta	Genesse	Bitterroot point	quartzite	complete	50	20	n/a	bi-convex	n/a	complete	no picture	Ronaghan et al. 1983:10-10, plate 59
FiPo-207	n/a	Alberta	Genesse	Bitterroot point	quartzite	complete	60	30	n/a	bi-convex	n/a	complete	no picture	Ronaghan et al. 1983:10-10, plate 59
FiQe-20	5	Alberta		sheep residue	pink quartzite	complete	129	69	18	bi-convex	1.5:1	complete	Plate 9	Meyer Roe and Langer 2008
FiQi-1	1	Alberta	McPherson Creek area	n/a	fine-grained grey quartzite	complete	113	48	10	n/a	n/a	complete	Plate 17	McCullough 1982:37-38
FjQi-5	11	Alberta		n/a	light grey fine- grained quartzite	broken (50%)	104	38	17	plano-triangular	n/a	snap-hinge	Plate 14	Meyer 2004:454, 464
FjQk-24	1	Alberta		n/a	pink fine-grained quartzite	broken	52	40	10	bi-convex	n/a	snap-hinge	Plate 14	Meyer 2004:454, 464
FjQk-7	1	Alberta		n/a	dark grey fine- grained quartzite	broken (60%)	57	49	10	plano-convex	n/a	radial	Plate 14	Meyer 2004:139, 464
FjQl-46	9	Alberta		n/a	pink fine-grained quartzite	complete	86	49	13	bi-convex	1.3:1	complete	Plate 6	Meyer, Roe and Langer 2008
FkQj-11	32	Alberta		n/a	light grey fine- grained quartzite	broken (60%)	56	48	11	bi-convex	n/a	radial	Plate 15	Meyer 2004:455, 465
FkQj-17	7	Alberta		n/a	light grey fine- grained quartzite	broken (<50%)	58	60	11	plano-convex	n/a	radial	Plate 15	Meyer 2004:455,465

Table A.1: Complete List of Known Embarras Bipoints

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete/ Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Dorsal to Ventral Ratio	Fracture Pattern	Plate	Reference
FkQj-9	36	Alberta	oldman creek	n/a	light grey fine-grained quartzite	broken (40%)	53	37	9	plano-convex	n/a	snap	Plate 14	Meyer 2004:454, 465
FkQl-14	13	Alberta		n/a	pink fine-grained quartzite	broken (<50%)	50	73	11	plano-convex	n/a	snap	Plate 16	Meyer and Roe 2006:542,550
FkQl-26	2	Alberta		n/a	grey fine-grained quartzite	complete	131	85	22	plano-convex	3.7:1	complete	Plate 7	Meyer et. al 2007:548; Meyer et al. 2008:510, 518
FlQh-12	1	Alberta		Embarras Bipoints	grey fine grained quartzite	broken	65	52	13	bi-convex	n/a	perverse	Plate 16	Meyer, Roe and Langer 2008
FlQh-12	2	Alberta		Embarras Bipoints	pink quartzite	broken	64	38	10	bi-convex	n/a	perverse	Plate 15	Meyer, Roe and Langer 2008
FlQh-12	3	Alberta		Embarras Bipoints, deer residue	light grey quartzite	complete	83	40	12	bi-convex	2.2:1	complete	Plate 9	Meyer, Roe and Langer 2008
FlQh-13	2	Alberta		Embarras Bipoints	quartzite	broken	33	45	8	bi-convex	n/a	perverse	Plate 15	Meyer, Roe and Langer 2008
FlQh-13	3	Alberta		Embarras Bipoints	quartzite	broken	59	37	10	plano-convex	n/a	radial	Plate 15	Meyer, Roe and Langer 2008
FlQi-3	175	Alberta		Erith Knife	quartzite	complete	116	68	29	plano-convex	n/a	complete	Plate 10	Meyer 2004: 454, 462
FlQj-16	12	Alberta			quartzite	broken	47	33	7	bi-convex	n/a	perverse	Plate 16	Meyer, Roe and Langer 2008
FlQj-29	2	Alberta			dark grey fine- grained quartzite	complete	119	71	27	plano-convex	3.7:1	complete	Plate 7	Meyer, Roe and Langer 2008
GbPv-1	585	Alberta	Carson Pegasus site		dark grey quartzite	complete	69	45	11	plano-convex	n/a	complete	no picture	Ronaghan and Hanna 1981:95-96, 107
GbPv-1	897	Alberta	Carson Pegasus site		light grey quartzite	complete	76	46	14	plano-convex	n/a	complete	no picture	Ronaghan and Hanna 1981:95-96, 107
Road surface find	n/a	Alberta	Ronaghan and L. Lefluer	n/a	pink fine-grained quartzite	complete	117	63	21	plano-convex	1.5:1	complete	Plate 8	no reference

Table A.1: Complete List of Known Embarras Bipoints

Borden Number	Cat. #	Province	Site Name	Other Diagnostics	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Transverse Cross Section	Plate	Reference
FdPe-4	h78.22. 168	Alberta	The Boss Hill Site	E.M.P. points, Reverse Uniface	mudstone	mostly complete	129	56	17	n/a	Plate 21	Doll 1982:44,149
FfQh-26	2725	Alberta		Mummy Cave points	Nordegg Member Silicified Siltstone	2 pieces refit	54	61	7	bi-convex	Plate 22	Meyer et al. 2007:83, 316
FgQe-14	218	Alberta		dart point	Nordegg Member Silicified Siltstone	50%	54	39	12	plano-convex	Plate 22	Calder and Reeves 1977:12, 43
FgQe-14	3139	Alberta		dart point	pink quartzite	complete	62	30	7	plano-triangular	Plate 22	Calder and Reeves 1977:15,
FgQe-14	3271	Alberta		dart point	pink quartzite	complete	70	32	10	plano-convex	Plate 22	Calder and Reeves 1977:14,
FhQe-13	2	Alberta	Crusty Creek	Erith Knife	pink-orange fine-grained quartzite	broken (50%)	44	45	10	plano-convex	Plate 22	Meyer and Roe 2006:542, 549
FhQg-2	179	Alberta		Embarras Bipoints, dart/ spear point tip	grey fine-grained quartzite	complete	65	48	10	plano-convex	no picture	Calder and Reeves 1978:7-8, 31
FiQq-8	103	Alberta		n/a	Glacier Pass Silicified Mudstone	broken (80%)	90	34	n/a	n/a	Plate 21	Anderson and Reeves 1975
FkQk-9	36	Alberta		n/a	dark grey fine-grained	complete	87	63	16	plano-convex	Plate 22	Meyer et al. 2007:548; Meyer et al. 2008:510,
IfPo-1	n/a	Alberta	Wentzel Lake	5,220 b.p.	quartzite	complete	70	40	n/a	n/a	Plate 21	Conaty 1977:31-36
IgOg-2	n/a	Alberta		2,500 b.p.	quartzite	complete	96	53	14	n/a	Plate 21	Wright 1975:121-122, 179
n/a	surface finds	Alberta	Fond Du Lac Site	2,500 b.p.	quartzite	complete	121	45	12	n/a	Plate 21	Wright 1975:103, 139, 163

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
DgMr-1	9 points	Sask.	The Long Creek Site	4,620+/-80, 4,650+/-150 4,993+/-125	Bitterroot, Salmon River, Pre-Oxbow points	quartzites and cherts	n/a	n/a	n/a	n/a	Mayer-Oakes 1960:69; Reeves 1972, Wettlaufer 1960
DgPl-85	1 point	Alberta		pre-5,500 B.C.	Embarras Bipoint , Bitterroot point	chert	complete	30*	15*	n/a	Reeves 1972
DhPh-56	1	Alberta	St. Mary Resevoir	n/a	Bitterroot, Salmon River point	chert	complete	27*	20*	5*	Meyer et al. 2002
DhPh-89	3	Alberta	St. Mary Resevoir	n/a	Bitterroot, Salmon River points	chert	complete	27*	20*	5*	Meyer et al. 2002
DjOn-26	>25 points	Alberta	The Stampede Site	4,660+/-38, 5,230+/-100, 6,100+/-90, 6,110+/-90 6,195+/-45, 7,245+/-255, 7,115+/-50, 6,100+/-70, 6,195+/-454	Mummy Cave, Bitterroot points, Reverese Unifaces	quartzites, cherts, silicified siltstones	complete and broken	n/a	n/a	n/a	Gryba 1978; Oetelaar n.d.; Vivian, Meyer, Roe and Blakey 2008
DjPm-36	10 points	Alberta	The Snyder Farm Locality	5,920+/-170	Gowan points	n/a	complete and broken	n/a	n/a	n/a	Van Dyke 1994
DjPn-9	n/a	Alberta		Late Mummy Cave 5,000-3,500 y.b.p.	Bitterroot and Salmon River points	cherts	complete and broken	26-47	15-20	3-6	Quigg and Reeves 1975
DjPn-90	1 point	Alberta	The Jensen Springs Site	6,040+/-450	Jensen point	n/a	n/a	n/a	n/a	n/a	Ronaghan 1992
DjPo-107	n/a	Alberta	The Green Creek Site	n/a	Bitterroot, Salmon River points	n/a	n/a	n/a	n/a	n/a	Kenney et al. 1985
DjPo-47	6 points	Alberta	The Maple Leaf Site	7,280+/-230, 6,420+/-60	Maple Leaf, Jensen points	n/a	n/a	n/a	n/a		Reeves and Driver 1978; Landals1986
DjPo-9	1 point	Alberta		4,740+/-130	Bitterroot point	Etherington Chert	complete	28	19	7	Calder et al. 1980, Reeves 1976

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
DjPp-29	2 points	Alberta		5,000-3,500 y.b.p.	Salmon River point	chert and obsidian	broken	22*	16*	3-4*	Reeves et al 1976
DjPp-30	1 point	Alberta		7,500-1,400 y.b.p.	Bitterroot point	grey chert	broken	n/a	19	5	Reeves et al 1976
DjPp-8	>10 points	Alberta		n/a	Early Middle period points	quartzites, cherts, silicified siltstones	complete and broken	n/a	n/a	n/a	Reeves 1974; Driver 1978, 1983; Meyer and Roe 2008
DjPq-1	n/a	British Columbia		n/a	Bitterroot, Salmon River points	quartzites, cherts, silicified siltstones	complete and broken	n/a	n/a	n/a	Kenney et al. 1985
DkPj-1	>10	Alberta	Head-Smashed-In	5,460+/-200, 7,065+/-175	Bitterroot, Oxbow, Northern Side-Notched points	porcellanite	broken	20*	25*	n/a	Brink et al. 1985; Reeves 1972
DlPo-20	2 points	Alberta	The Gap Site	6110+/-140, 6770+/-140	Bitterroot points	black Paleozoic chert	broken	30	19	n/a	Reeves and Dormaar 1972
EaLa-1	n/a	Manitoba	LM-8, White Mouth Falls Site	7,400-6,400 y.b.p.	Browns Valley points	green quartzite	complete	50*	25*	n/a	Buchner 1979
EgPm-3	3 points	Alberta	The Mona Lisa Site	5,715+/-150, 5,390+/-170	Maple Leaf points	black chert/silicified siltstone	broken	n/a	n/a	n/a	Wilson 1980
EgPm-179	3 points	Alberta	The Hawkwood Site	7275 +/-215	Bitterroot, Salmon River points	cherts, silicified siltstones	complete and broken	33-46	20-21	6-17	Van Dyke and Stewart 1985:22-23,218.
EgPn-87	2 points	Alberta		5,800+/-80	Maple Leaf points	n/a	broken	n/a	n/a	n/a	Head and Hanna 2000
EgPn-230	8 points	Alberta		7,030+/-70	Everblue points	cherts,silicified sitlstones	complete and broken	n/a	n/a	n/a	Vivian 1998
EgPn-480	2 points	Alberta		4,610+/-70	Pre-Oxbow points	n/a	n/a	n/a	n/a	n/a	DeMille and Head 2001
EgPn-625	16 Points	Alberta	The Gooseberry Kill Site	7110+/-60	Burmis-Barbed points	n/a	complete and broken	n/a	n/a	n/a	Vivian, Roe, and Blakey 2008
EgPn-700	7 points	Alberta	The Everblue Springs Site	7,430+/-70, 7,820 +/-50	Burmis-Barbed points	cherts, quartz	complete and broken	48-68	24-31	5-9	Vivian 2007

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
EgPr-2	346, 347, 3057, 5254, 5349, 5587, 4822	Alberta	The Sibbald Creek Site	5,850+/-190, 7645+/-260	Oxbow, Mt. Albion points	chert, chalcedony, siltstone	complete and broken	n/a	n/a	n/a	Gryba 1983:58-63, Walker 1992:197
EhPv-8	9 points	Alberta	The Vermilion Lakes Site	n/a	Bitterroot points	n/a	complete and broken	n/a	n/a	n/a	Fedje 1986
FaNq-25	N=23	Sask.	The Gowan 1 Site	5670+/-135, 5760+/-135, 6065+/-200, 6150+/-110	Gowan points	chert, chalcedony, siltstone	complete and broken	27*	18*	6*	Walker 1992:26, 45-46
FaNq-32	N=87	Sask.	The Gowan 2 Site	5665+/-110, 5910+/-165, 5915+/-130, 6075+/-160	Gowan points	chert, chalcedony, siltstone	complete and broken	29*	15*	4*	Walker 1992:26, 83-85
FcPu-2	1	Alberta		n/a	Mummy Cave point	Nordegg Member Silicified Siltstone	complete	25	19	4	Somer 2006:68, 158
FdOt-1	6 points	Alberta	The Anderson Site	5,460+/-160, 4,725+/-150	Bitterroot, Pre-Oxbow points	quartzites	complete and broken	21 to 37	16 to 19	5 to 6	Quigg 1979; Quigg 1984:154-155
FdPe-4	4 Points	Alberta	The Boss Hill Site	6150+/-95, 7,875+/-130, 7,750+/- 105	Burmis-Barbed, Boss Hill Points, Reverse Unifaces	quartzites, siltstone and cherts	n/a	n/a	n/a	n/a	Doll 1982
FfNk-7		Sask.	St. Lois site	n/a	Mummy Cave points	n/a	n/a	n/a	n/a	n/a	Johnson 2005
FfQh-26	6	Alberta		n/a	Early Middle Period point	cherts, silicified siltstones, pebble chert, white semi-translucent chert	complete and broken	27-32	19-21	6-May	Meyer et al. 2007

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
FfQm-26	191R1B2-8	Alberta	The Patricia Lake Site	n/a	Large Stemmed Point	dark grey quartzite	complete	43	23	6	Pickard 1985:14,77
FfQm-26	191R2A2-12	Alberta	The Patricia Lake Site	n/a	Large Stemmed Point	basalt	complete	36	19	5	Pickard 1985:14,77
FfQm-26	191R2A7-3	Alberta	The Patricia Lake Site	n/a	Side Notched point	basalt	complete	34	16	5	Pickard 1985:15,79
FgQe-14	1153	Alberta		4,500-5,00 B.C.	Salmon River Side Notched	light grey, fine-grained quartzite	broken	27	21	5	Calder and Reeves 1977:10,43
FgQe-14	2593	Alberta		4,500-5,00 B.C.	small triangular	white-maroon chert	complete	33	21	6	Calder and Reeves 1977:12,43
FgQe-14	3139	Alberta		4,500-5,00 B.C.	point/knife?	pink quatzite	complete	62	28	7	Calder and Reeves 1977
FgQe-14	3271	Alberta		4,500-5,00 B.C.	point/knife?	pink quatzite	complete	70	34	10	Calder and Reeves 1977
FgQe-14	4046	Alberta		4,500-5,00 B.C.	Oxbow point	dark grey, fine-grained quartzite	complete	25	19	4	Calder and Reeves 1977:11, 43
FgQe-14	4060	Alberta		4,500-5,00 B.C.	Salmon River Side- Notched	white-pink fine-grained quartzite	mostly complete	28	17	6	Calder and Reeves 1977:10, 43
FgQe-14	4134	Alberta		4,500-5,00 B.C.	triangular unnotched atlatl	grey quartzite	complete	44	18	7	Calder and Reeves 1977:10,43
FgQe-16		Alberta		5,500-1,500 B.C.	Early Middle Period point	quartzites, cherts, silicified siltstones	n/a	n/a	n/a	n/a	Calder and Reeves 1977
FgQf-10	865	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period	silicified siltstone	broken, base	n/a	14	n/a	Hunt 1982: 81, 88-89 table 18
FgQf-16	1002	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	Nordegg Member Silicified Siltstone	broken	21	18	5	Meyer and Roe n.d.

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
FgQf-16	1003	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	Nordegg Member Silicified Siltstone	complete	25	19	6	Meyer and Roe n.d.
FgQf-16	1004	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	Nordegg Member Silicified Siltstone	complete	27	17	4	Meyer and Roe n.d.
FgQf-16	1005	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	silicified limestone	broken	35	22	5	Meyer and Roe n.d.
FgQf-16	1006	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	complete	25	16	5	Meyer and Roe n.d.
FgQf-16	1031	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	complete	26	16	5	Meyer and Roe n.d.
FgQf-16	1032	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	complete	34	24	6	Meyer and Roe n.d.
FgQf-16	1033	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	Nordegg Member Silicified Siltstone	complete, refitted	28	13	3	Meyer and Roe n.d.
FgQf-16	1036	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	broken	12	16	5	Meyer and Roe n.d.
FgQf-16	1049	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	silicified limestone	complete	34	18	5	Meyer and Roe n.d.
FgQf-16	1051	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	Nordegg Member Silicified Siltstone	complete, refitted	46	16	5	Meyer and Roe n.d.
FgQf-16	1094	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	silicified siltstone	complete, refitted	21	15	3	Meyer and Roe n.d.
FgQf-16	1177	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	broken, base	19	20	5	Meyer and Roe n.d.
FgQf-16	1234	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	quartzite	broken, base	30	31	10	Meyer and Roe n.d.
FgQf-16	1493	Alberta	The Upper Lovett Campsite	7,000-4,000	Early Middle Period points	chert	broken, base	18	23	8	Meyer and Roe n.d.

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
FhNg-25		Sask.	Below Forks Site	5,740+/-95, 7,500-5,000 y.b.p.	n/a	n/a	n/a	n/a	n/a	n/a	Kaastan 2004; Roskowski 2004; Meyer 2002 Walker 1992
FhQf-10	819	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period point	silicified siltstone	complete	30	19	4	Hunt 1982:81,87, table 18
FhQf-10	822	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period point	silicified siltstone	complete	29	18	4	Hunt 1982:81-83 table 18
FhQf-10	852	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period point	banded chert	complete	34	22	6	Hunt 1982:81, 86 table 18
FhQf-10	955	Alberta	Robb sites	4,000 to 5,000 years b.p.	Mummy Cave point	quartzite	broken (50%)	23	20	7	Hunt 1982:81, 86 table 18
FhQf-10	1051	Alberta	Robb sites	4,000 to 5,000 years b.p.	unnotched oxbow	quartzite	complete	42	23	7	Hunt 1982:75, 81 table 18
FhQf-10	1119	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period point	quartzite	complete	32	19	4.7	Hunt 1982:81, 88 table 18
FhQf-10	1170	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period	quartzite	complete	43	22	12	Hunt 1982:81, 84-85 table 18
FhQf-10	1171	Alberta	Robb sites	4,000 to 5,000 years b.p.	Early Middle Period point	silicified siltstone	complete	27	17	5	Hunt 1982:81, 87 table 18
FhQf-10	1250	Alberta	Robb sites	4,000 to 5,000 years b.p.	Mummy Cave point	Nordegg Member Silicified Siltstone	complete	32	23	6	Hunt 1982:81, 88 table 18
FhQg-2	583	Alberta		5,000 B.C.	identified as a dart tip	dark grey pebble chert	broken	22	23	4	Calder and Reeves 1978:6,31
FiPn-220	n/a	Alberta	The Gennesse Sites	7,830+/-100	n/a	n/a	n/a	n/a	n/a	n/a	Ronaghan et al. 1983
GbPv-1	222	Alberta	Carson Pegasus	n/a	Bitterroot	fine-grained red quartzite	complete	32	22	5	Ronaghan and Hanna 1981:92-93,106
GbPv-1	962	Alberta	Carson Pegasus	n/a	Oxbow point	grey-white quartzite	complete	24	18	6	Ronaghan and Hanna 1981:93,106
HhOv-143	1 point	Alberta		n/a	Salmon River point	quartzite	complete				Lifeways of Canada Report n.d.
IfPo-1	1 point	Alberta	Wentzel lake	5220 b.p.	Large Side-Notched point	quartzite	complete	45	25	n/a	Conaty 1977:36
	1 point	Alberta	Brule Lake Site	7,010+/-1860	Mummy Cave point	n/a	n/a	n/a	n/a	n/a	Meyer et al. 2002:15-18

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. # or # of artifacts	Province	Site Name	Date(s)	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Reference
	n/a	Alberta	The Mountain Creek Site	6,620+/-120	n/a	n/a	n/a	n/a	n/a	n/a	Meyer et al. 2002:15-18
	n/a	Alberta	The Track Site	3,450+/-450	n/a	n/a	n/a	n/a	n/a	n/a	Meyer et al. 2002:15-18
48FR308	n/a	Wyoming	The Helen Lookingbill Site	7,140+/- 160, 6,000 to 9,000 years b.p.	Bitterroot and Mummy Cave points	quartzites and cherts	n/a	n/a	n/a	n/a	Frison 1983; Kornfeld et al. 2001
48PA201	>10 points	Wyoming	The Mummy Cave Site	5,255+/-140, 5,390+/-140, 5,610+/-280, 5,800+/-120, 6,780+/-130, 7,140+/-170 7,630+/-170	Mummy Cave points	quartzites, cherts, silicified siltstones	complete and broken	n/a	n/a	n/a	McCracken et al 1978; Husted and Edgar 2002; Wedel et.al. 1968
5BL70	n/a	Colorado	Mount Albion Site	5650+/-145, 5350+/-130	Mount Albion points	n/a	complete and broken	n/a	n/a	n/a	Benedict and Olson 1978; Walker 1992:179
48BH345	n/a	Wyoming	The Laddie Creek Site	5,700+/-160, 6,650+/-480, 6,830+/-260	n/a	n/a	n/a	n/a	n/a	n/a	Frison 1978; Larson 1990
		Wyoming	The Spanish Point Quarry	6,200+/-170	n/a	n/a	n/a	n/a	n/a	n/a	Frison 1978
48CK303	>10	Wyoming	The Hawken Site	6,270+/-170, 6,470+/-140	early Side-Notched points	quartzites and cherts	complete and broken	23-68	15-27	4-6	Frison 1976

*: approximate dimensions

Table A.3: A Selection of Early Middle Period Sites.

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
DjOn-26	207220	Alberta	the Stampede Site	Reverse Uniface	green quartzite	broken	114	63	19		Vivian et al. 2008
DjOn-26	207221	Alberta	the Stampede Site	Reverse Uniface	quartzite	broken	46	44	16		Vivian et al. 2008
EgNp-63	n/a	Sask.	Lake Diefenbaker cache	Reverse Uniface	quartzite	n/a	n/a	n/a	n/a		Johnson 1994:80-82
EgNr-2	n/a	Sask.		Reverse Uniface	quartzite	n/a	n/a	n/a	n/a		Stevenson 1992:3-4
EgPn-624	2089	Alberta		Reverse Uniface	quartzite	complete	112	80	48		Vivian et al. 2008
EgPn-624	2090	Alberta		Reverse Uniface	quartzite	complete	128	80	34		Vivian et al. 2008
EgPn-624	5227	Alberta		Reverse Uniface	quartzite	complete	121	72	27		Vivian et al. 2008
EgPn-624	5537	Alberta		Reverse Uniface	quartzite	complete	69	38	19		Vivian et al. 2008
EgPr-2	4917	Alberta	Sibbald Creek Site	Reverse Uniface	quartzite	complete	60	43	13		Gryba 1983:99,102-103
EqNq-18	n/a	Sask.		Reverse Uniface	quartzite	n/a	n/a	n/a	n/a		Stevenson 1992:3-4
FaNq-25	N=23	Sask.	The Gowan 1 Site	Reverse Unifaces	quartzite	complete and broken	44*	40*	16*		Walker 1992:55-57
FaNq-32	N=37	Sask.	The Gowan 2 Site	Reverse Unifaces	quartzite	complete and broken	49*	40*	17*		Walker 1992:83-85
FbNp-24	specimen 7	Sask.	the Dog Child Site	Reverse Uniface	quartzite	complete	53	60	30		Cyr 2006:120-121

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FdOt-1	175	Alberta	The Anderson Site	Reverse Uniface	quartzite	complete	62	40	18		Quigg 1984:154-155
FdOt-1	182	Alberta	The Anderson Site	Reverse Uniface	quartzite	complete	79	60	22		Quigg 1984:154-155
FdPe-4	h77.55.375	Alberta	the Boss Hill Site	Reverse Uniface	quartzite	broken	127	85	25		Doll 1982:51,132,157
FdPe-4	h78.22.171	Alberta	the Boss Hill Site	Reverse Uniface	quartzite	broken	122	71	30		Doll 1982:51,132,157
FgNh-58	n/a	Sask.	Birch Hills Ferry Site	Reverse Uniface	quartzite?	n/a	n/a	n/a	n/a		Wilson 1982:946-947
FgQe-14	2949	Alberta		Erith Knife	light pink fine-grained quartzite	mostly complete	66	37	14	Plate 26	Calder and Reeves 1977:12, 43
FgQe-14	2266	Alberta		large burinated biface	light grey fine-grained quartzite	broken	79	37	19		Calder and Reeves 1977:14-15, 44
FgQe-16	383	Alberta		Lovett Uniface	white quartzite	broken	68	71	15	Plate 27	Calder and Reeves 1977:15, 44; Meyer 2003:199
FgQe-60	1	Alberta		Lovett Uniface	light grey fine-grained quartzite	complete (refitted)	72	45	8	Plate 27	Meyer 2003:416,425
FgQe-60	13	Alberta		Reverse Uniface	red quartzite	broken (<50%)	61	55	21		Meyer 2003:419

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FgQf-117	1	Alberta		Erith Knife (Caribou)	light grey fine-grained quartzite	broken (>70%)	91	48	17	Plate 26	Meyer 2003:198, 417,423
FgQf-119	1	Alberta		large rectangular biface	light grey fine-grained quartzite	broken (80%)	112	72	16	Plate 23	Meyer 2003:418,423
FgQf-152	6	Alberta		Erith Knife	grey quartzite	broken	41	36	12	Plate 26	Meyer 2004: 455, 463
FgQf-16	1009	Alberta	Upper Lovett Campsite	biface fragment	quartzite	broken	73	38	13		Meyer and Roe n.d.
FgQf-16	1011	Alberta	Upper Lovett Campsite	Erith Knife	grey fine grained quartzite	broken (80%)	73	43	14		Meyer and Roe n.d.
FgQf-16	1062	Alberta	Upper Lovett Campsite	biface fragment	quartzite	broken	46	76	18		Meyer and Roe n.d.
FgQf-16	1010	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	broken (80%)	86	65	19	Plate 25	Meyer and Roe n.d.
FgQf-16	1012	Alberta	Upper Lovett Campsite	Reverse Uniface	grey quartzite	complete	111	70	19	Plate 25	Meyer and Roe n.d.
FgQf-16	1022	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	complete	90	58	14	Plate 25	Meyer and Roe n.d.

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FgQf-16	1025	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	complete	73	49	21		Meyer and Roe n.d.
FgQf-16	1027	Alberta	Upper Lovett Campsite	Reverse Uniface	medium grey quartzite	broken	115	40	23	Plate 25	Meyer and Roe n.d.
FgQf-16	1063	Alberta	Upper Lovett Campsite	Reverse Uniface	medium grey quartzite	broken	47	61	20	Plate 25	Meyer and Roe n.d.
FgQf-16	1065	Alberta	Upper Lovett Campsite	Reverse Uniface	dark grey quartzite	complete	61	71	21		Meyer and Roe n.d.
FgQf-16	1066	Alberta	Upper Lovett Campsite	Reverse Uniface	purple quartzite	broken	59	56	20		Meyer and Roe n.d.
FgQf-16	1075	Alberta	Upper Lovett Campsite	Reverse Uniface	black quartzite	broken	90	19	15		Meyer and Roe n.d.
FgQf-16	1090	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey quartzite	broken	78	62	23		Meyer and Roe n.d.
FgQf-16	1102	Alberta	Upper Lovett Campsite	Reverse Uniface	dark grey quartzite	complete	72	51	20		Meyer and Roe n.d.
FgQf-16	1176	Alberta	Upper Lovett Campsite	Reverse Uniface	dark grey quartzite	broken	33	43	12	Plate 25	Meyer and Roe n.d.
FgQf-16	1187	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	broken	75	59	17		Meyer and Roe n.d.

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FgQf-16	1211	Alberta	Upper Lovett Campsite	Reverse Uniface	light green quartzite	mostly complete	81	65	23	Plate 25	Meyer and Roe n.d.
FgQf-16	1220	Alberta	Upper Lovett Campsite	Reverse Uniface	dark grey quartzite	broken	42	79	24		Meyer and Roe n.d.
FgQf-16	1223	Alberta	Upper Lovett Campsite	Reverse Uniface	light pink fine-grained quartzite	broken	69	28	16		Meyer and Roe n.d.
FgQf-16	1251	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	broken	112	68	26	Plate 25	Meyer and Roe n.d.
FgQf-16	9445	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	broken	56	53	16	Plate 25	Meyer and Roe n.d.
FgQf-16	9774	Alberta	Upper Lovett Campsite	Reverse Uniface	light grey fine-grained quartzite	complete	92	49	20		Meyer and Roe n.d.
FgQf-16	9775	Alberta	Upper Lovett Campsite	Reverse Uniface	purple quartzite	complete	122	89	37		Meyer and Roe n.d.
FgQf-180	n/a	Alberta	ARESCO site	Lovett Uniface	quartzite	complete	60*	40*	n/a	Plate 27	ARESCO 2006
FgQf-62	140, 1473, 1474, 1477, 1478	Alberta		Nezu Knife (Lovett Uniface)	grey quartzite	mostly complete, refitted	126	64	10		Meyer et al. 2002:81,82, 84, 187-190

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FgQf-67	118	Alberta		large biface	light grey fine-grained quartzite	broken (<50%)	76	32	21		Meyer et al. 2002:183, 190-191
FgQf-67	119	Alberta		large biface	light grey fine-grained quartzite	broken (<50%)	62	38	14		Meyer et al. 2002:183, 191
FgQf-73	1	Alberta		Erith Knife	pink quartzite	broken (50%)	37	30	10	Plate 26	Meyer et al. 2002:183,191; Meyer 2003:198, 417, 423
FgQf-9	26	Alberta		Lovett Uniface	grey quartzite	broken (60%)	58	32	9		Meyer 2003:416,425
FhNg-25	1153	Sask.	Below Forks Site	Reverse Uniface	quartzite	complete	41	34	9		Kasstan 2004: 104,241
FhNg-25	4236	Sask.	Below Forks Site	Reverse Uniface	quartzite	complete	41	28	8		Kasstan 2004: 104,241
FhNg-25	5062	Sask.	Below Forks Site	Reverse Uniface	quartzite	complete	51	39	15		Kasstan 2004: 104,241
FhNg-25	11075	Sask.	Below Forks Site	Reverse Uniface	Swan River Chert	complete	23	29	5		Kasstan 2004: 104,241
FhQe-15	n/a	Alberta		Reverse Uniface	purple-grey quartzite	complete	90	60	30		Ronaghan and Reeves 1981: I-5, Plate 3
FhQe-18	1	Alberta		biface	grey fine-grained quartzite	broken (<50%)	54	27	12		Meyer et al. 2008:510, 520
FhQe-18	2	Alberta		large bifacial knife	quartzite	complete	88	33	11	Plate 24	Meyer et al. 2007:547-8

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FhQe-18	59	Alberta		biface	pink fine-grained quartzite	broken (90%)	66	38	13		Meyer et al. 2007:549; Meyer et al. 2008:510, 519
FhQe-21	1	Alberta		large biface	dark grey fine-grained quartzite	broken	26	57	17		Meyer et al. 2008:510, 519
FhQf-10	2	Alberta	Robb sites	Reverse Uniface	dark grey quartzite	complete	80	57	21		Hunt 1982:104-106
FhQf-10	7	Alberta	Robb sites	Lovett Uniface	dark grey quartzite	broken	46	54	12	Plate 27	Hunt 1982: 104-106
FhQf-10	327	Alberta	Robb sites	Lovett Uniface	quartzite	broken	32	58	12	Plate 27	Hunt 1982:102
FhQf-10	889	Alberta	Robb sites	Reverse Uniface	grey quartzite	broken	54	78	18		Hunt 1982:108-109
FhQf-10	910	Alberta	Robb sites	Lovett Uniface	quartzite	complete	128	77	13	Plate 27	Hunt 1982:104, 107
FhQf-10	927	Alberta	Robb sites	large biface	light grey fine-grained quartzite	broken (50%)	63	57	14	Plate 23	Hunt 1982:93-95
FhQf-10	974	Alberta	Robb sites	large biface	light grey fine-grained quartzite	broken	51	91	15	Plate 23	Hunt 1982:93, 95
FhQf-10	1251	Alberta	Robb sites	bifacial knife	pink fine-grained quartzite	complete	88	41	12	Plate 24	Hunt 1982:99
FhQf-37	1	Alberta		Reverse Uniface	quartzite	complete	137	101	45		Meyer 2003:430
FhQf-89	15	Alberta	McNeil Creek biface	large biface	quartzite	complete	170	120	27		Meyer and Roe 2006:542, 547

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FhQg-68	1	Alberta		bifacial knife	quartzite	complete	132	61	19		Meyer and Roe 2009
FhQg-75	1	Alberta		bifacial knife	quartzite	complete	99	44	14		Meyer and Roe 2009
FiQm-13	1	Alberta		bifacial knife	light grey fine-grained quartzite	complete	95	52	8	Plate 24	Meyer et al. 2007:194,547; Meyer et al. 2008:507, 517
FjQl-9	1	Alberta		large rectangular biface	light grey fine-grained quartzite	broken (80%)	114	81	21	Plate 23	Meyer 2004:455, 462
FkQj-35	41	Alberta		Lovett Uniface	grey quartzite	broken (50%)	46	87	17		Meyer and Roe 2006:541, 551
FkQk-15	47	Alberta		large rectangular biface (preform)	dark grey fine-grained quartzite	complete	150	133	33		Meyer et al. 2007:548; Meyer et al. 2008:508, 518
FkQl-15	49	Alberta		Reverse Uniface	grey quartzite	broken (50%)	70	101	24		Meyer and Roe 2006:541, 551
FkQl-22	21	Alberta		large biface	grey fine-grained quartzite	broken (<40)	64	39	12		Meyer et al. 2008:510, 519
FkQl-73	3	Alberta		Erith knife	quartzite	broken (<50%)	63	52	18	Plate 26	Meyer et al. 2008
FlQg-1	2	Alberta		Reverse Uniface	light grey fine-grained quartzite	complete	91	64	34		Meyer 2005c
FlQi-11	1	Alberta		bifacial knife	grey fine-grained quartzite	complete	65	38	13	Plate 24	Meyer et al. 2007:194; Meyer et al. 2008:507, 517

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Borden Number	Cat. #/ # of Artifacts	Province	Site Name	Tool Type	Material Type	Complete /Broken	Length (mm)	Width (mm)	Thickness (mm)	Plate	Reference
FlQi-3	172	Alberta		Erith Knife	light grey fine-grained quartzite	broken (50%)	86	67	15	Plate 26	Meyer 2004:455, 466
HhOv-483	48079	Alberta		Reverse Uniface	quartzite	complete	*70	*50	n/a		Roskowski n.d.
HhOv-484	222857	Alberta		Reverse Uniface	quartzite	complete	*60	*40	n/a		Roskowski n.d.
HhOx-11	3	Alberta		Reverse Uniface	quartzite	complete	*60	*50	n/a		Roskowski n.d.
n/a	n/a	Sask.	East Village Access site	Reverse Unifaces	quartzite	n/a	n/a	n/a	n/a		Kasstan 2003
n/a	n/a	Sask.	Niska Site	Reverse Uniface	quartzite	n/a	n/a	n/a	n/a		David Meyer 1985:5
n/a	n/a	Alberta	Peace River area/Harold Matlock collection	bipointed biface cache	quartzite	complete	*160	*60	n/a		Peace Past Project n.d.:37
n/a	n/a	Alberta	Morton Downey Collection	bipointed biface cache	quartzite?	complete	*230	*70	n/a		Wormington and Forbis 1965:180-81
GlOc-2	N=5	Sask.	The Chartier Site	bipointed points	quartz and fused sandstone	broken	24-45	19-26	6-11	Figure 5.3	Millar 1983:142-143
LM-8	n/a	Manitoba	Caribou Lake Sites	bipointed points	green quartzite	complete	150	45	n/a	Figure 5.4	Buchner 1979:29, 79, 157

*: approximate dimensions

Table A.4: Other Diagnostic Early Middle Period Stone Tools

Cobble Number	Material Type	Action	Number of Actions	Results
1	quartzite	bipolar	2	2 perfect split spalls with very little debitage.
2	quartzite	bipolar	2	Spall one third, two thirds left, full of internal fractures. One spall good to work rest is not good
3	quartzite	bipolar	6	Tried in two directions resulting in one good spall
7	quartzite	bipolar	± 20	Removed 4 large spalls, did not split cobble, thinned core can be used for further work.
8	quartzite	bipolar	± 12	Failed because of internal flaws produced one spall that was split in two. Cannot be used.
9	quartzite	bipolar	± 12	Worked in two directions that thinned the cobble. Thinned cobble can be used.
11	quartzite	bipolar	4	Split the cobble but has lots of internal fractures so may fail when used.
14	quartzite	bipolar	1	Shattered when hit width-wise. Previous flake removal made the cobble weak. Cannot use.
16	quartzite	bipolar	3	Split into two spalls but there are a lot of internal flaws in the material. Will try to use but not hopeful.
21	quartzite	bipolar	± 15	Removed a number of large spalls that may be used. Thinned core can maybe used.
22	quartzite	bipolar	22	Shattered on internal fractures both from hitting the core so much and flaws in the stone. This one was blocky not rounded like the others so not a big surprise when bipolar did not work.
24	quartzite	bipolar	3	Failed because of internal flaws in the toolstone.
25	chert	bipolar	1	Perfect two spalls with very little debitage.
26	quartzite	bipolar	7	Action 2 produced a good spall. Action 7 split the cobble with some shatter-like pieces that may be used.
29	quartzite	bipolar	1	Failed because of internal flaws in the material. Produced nothing but shatter.
34	quartzite	bipolar	10	Action 3 produced a decent spall. Several other spalls were produced. Stopped when the core was too thin for bipolar percussion.
35	quartzite	throw	5	Action 2 produced a good spall. Action 3 produced a good spall. Action 5 produced a good spall. Core still useable.
36	quartzite	bipolar/ hard rest	6/1	Found out this was not quartzite when first six actions knocked off small flakes. Hard rest split cobble into two large pieces that may be useable.
37	quartzite	bipolar	± 15	Knocked off some smaller spalls. Action 15 quartered the cobble with two pieces that may be used.
38	quartzite	bipolar	± 20	Produced one possible spall the rest of the cobble was to damaged to use.
39	quartzite	throw	2	Produced one good spall and another spall that maybe used.
40	quartzite	bipolar	2	Action 2 split the cobble perfectly down the middle producing two useable pieces

Table A.5: Results of Early Stage Experiments

Cobble #	Material Type	Type	Starting Measurements Length (mm)	Width (mm)	Thickness (mm)	Action(s)	Success	Comments
1-a	quartzite	bipolar spall	120	110	40	hard and soft hammer percussion	completed	Same cobble as 1-b. Lost some material because of crushing and bruising damage.
1-b	quartzite	bipolar spall	120	100	20	hard and soft hammer percussion	completed	Worked well.
2	quartzite	bipolar cobble	115	100	50	hard and soft hammer percussion	failed	Broke along an internal fracture.
3	quartzite	bipolar spall	110	80	20	hard and soft hammer percussion	completed	Crushing and bruising caused some material loss.
4	quartzite	thrown spall	120	110	35	hard and soft hammer percussion	completed	Crushing caused some material loss.
5	quartzite	thrown spall	145	115	35	hard and soft hammer percussion	completed	Needed a lot of work and will require a lot of work at the tertiary stage.
6	quartzite	thrown spall	n/a	n/a	n/a	hard and soft hammer percussion	bypassed medial	Started with thrown spall and completed to tertiary stage.
7	quartzite	bipolar cobble	120	115	30	hard and soft hammer percussion	completed	Had a difficult cross section to work, meaning there was more work on the ventral surface than expected.
8	quartzite	bipolar spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
9	quartzite	bipolar spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
10	quartzite	thrown spall	170	120	60	hard and soft hammer percussion	completed	Thinning the cross section required a lot of work. lost a lot of material to internal flaws.
11	quartzite	bipolar spall	150	100	50	hard and soft hammer percussion	completed	Had to work the ventral surface a lot to thin.
12	quartzite	bipolar spall	118	103	42	hard and soft hammer percussion	completed	Cortex had incipient cones and there were several internal flaws resulting in unwanted flake terminations.
13	quartzite	thrown spall	160	120	65	hard and soft hammer percussion	completed	Had a semi-elliptical cross section that required a lot of work to thin and shape.
14	quartzite	bipolar spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
15	quartzite	thrown spall	n/a	n/a	n/a	hard hammer percussion	failed	There were to many internal flaws to complete.
16-a	quartzite	bipolar spall	120	110	40	hard and soft hammer percussion	failed	Same cobble as 16-b. Broke along internal flaw.

Table A.6: Results of Medial Stage Experiments

Cobble #	Material Type	Type	Starting Measurements Length (mm)	Width (mm)	Thickness (mm)	Action(s)	Success	Comments
16-b	quartzite	bipolar cobble	120	110	60	hard and soft hammer percussion	failed	Stalled out because of internal flaws in the toolstone.
17	quartzite	thrown spall	150	90	55	hard and soft hammer percussion	failed	Broke along a partially healed fracture.
18	quartzite	thrown spall	130	90	45	hard and soft hammer percussion	completed	Worked well.
19	quartzite	thrown spall	170	120	60	hard and soft hammer percussion	completed	Lots of internal flaws that caused a lot of material loss and may be an issue for tertiary stage.
20	quartzite	thrown spall	140	130	60	hard and soft hammer percussion	failed	Stalled out because of a texture change in the material.
21	quartzite	bipolar cobble	125	100	45	hard and soft hammer percussion	completed	Had to work the ventral surface a lot to thin.
22	quartzite	bipolar cobble	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
23	quartzite	thrown spall	155	110	50	hard and soft hammer percussion	failed	Broke on an internal flaw.
24	quartzite	bipolar cobble	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
25-a	quartzite	bipolar spall	140	90	25	soft hammer percussion	completed	Same cobble as 25-b. Had crushing, internal fractures and bruising that resulted in some material loss.
25-b	quartzite	bipolar spall	140	90	30	hard and soft hammer percussion	failed	Same cobble as 25-a. Broke because of end shock associated with an internal flaw in the toolstone.
26-a	quartzite	bipolar spall	100	90	20	hard and soft hammer percussion	completed	Same cobble as 26-b. Crushing caused some material loss.
26-b	quartzite	bipolar cobble	130	100	50	hard and soft hammer percussion	completed	Same cobble as 26-a. Internal flaws caused a lot of material damage.
27	quartzite	thrown cobble	170	130	90	hard hammer percussion	failed	Broke into three pieces along internal flaws.
28	quartzite	thrown spall	102	84	26	hard and soft hammer percussion	completed	Had issues with internal flaws.
29	quartzite	bipolar spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.

Table A.6: Results of Medial Stage Experiments

Cobble #	Material Type	Type	Starting Measurements Length (mm)	Width (mm)	Thickness (mm)	Action(s)	Success	Comments
30	quartzite	thrown spall	110	85	20	hard and soft hammer percussion	completed	Might be too small when completed.
31	quartzite	thrown spall	129	99	25	hard and soft hammer percussion	completed	Cortex had incipient cones caused some unwanted termination types.
32	quartzite	natural spall	110	100	35	hard and soft hammer percussion	failed	The quartzite was too course so the piece stalled.
33	quartzite	natural spall	110	100	35	hard and soft hammer percussion	completed	Had a number of fractures near the surface but was a solid piece towards the center.
34	quartzite	bipolar spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
35-a	quartzite	thrown cobble	180	125	70	hard and soft hammer percussion	completed	Same cobble as 35-b,c,d. Very thick to start but thinned well.
35-b	quartzite	thrown spall	140	100	40	hard and soft hammer percussion	completed	Same cobble as 35-a,c,d. Had some crushing that resulted in some material loss.
35-c	quartzite	thrown spall	110	80	15	soft hammer percussion	completed	Same cobble as 35-a,b,d. Had some crushing and bruising damage that resulted in material loss.
35-d	quartzite	thrown spall	140	100	20	soft hammer percussion	completed	Same cobble as 35-a,b,c. Needed only shaping actions.
36	not quartzite	percussion spalls	n/a	n/a	n/a	no actions taken	failed	Failed at the early stage experiments.
37	quartzite	bipolar spall	130	70	40	hard and soft hammer percussion	completed	Had a v-shaped ventral surface that required a lot of work to thin.
38	quartzite	bipolar spall	120	100	30	hard and soft hammer percussion	completed	Had a lot of crushing, internal flaws, and bruising damage.
39-a	quartzite	thrown spall	160	140	60	hard and soft hammer percussion	completed	Same cobble as 39-b. Internal flaws caused a lot of material loss.
39-b	quartzite	thrown spall	110	75	25	hard and soft hammer percussion	failed	Same cobble as 39-a. Broke on an internal flaw.
40-a	quartzite	bipolar spall	100	90	15	hard and soft hammer percussion	failed	Same cobble as 40-b. Broke along an internal flaw in the toolstone.
40-b	quartzite	bipolar spall	100	100	30	hard and soft hammer percussion	completed	Lost material to crushing and internal flaws.

Table A.6: Results of Medial Stage Experiments

Cobble #	Material Type	Starting Measurements Length (mm)	Starting Measurements Width (mm)	Starting Measurements Thickness (mm)	Finished Measurements Length (mm)	Finished Measurements Width (mm)	Finished Measurements Thickness (mm)	Action(s)	Completed	Plate	Comments
1-a	quartzite	120	110	40	81	54	14	soft hammer percussion, abrading	completed	Plate 28	
1-b	quartzite	120	100	20	n/a	n/a	n/a	soft hammer percussion, abrading	failed		Broke by a plunging flake.
2	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Failed at medial stage experiment.
3	quartzite	110	80	20	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
4	quartzite	100	70	25	99	59	17	soft hammer percussion, pressure flaking	completed	Plate 29	Stalled in one spot along one edge but the rest turned out ok.
5	quartzite	120	100	35	108	72	22	soft hammer percussion, abrading	completed	Plate 28	Stalled in one spot along one edge but the rest turned out ok.
6	quartzite	92	50	8	92	49	14	soft hammer percussion, pressure flaking	completed	Plate 28	Pressure flaking used for platform preparation flaking.
7	quartzite	120	115	30	n/a	n/a	n/a	soft hammer percussion, abrading	failed		Broke along internal flaw in the toolstone.
8	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
9	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
10	quartzite	170	120	60	111	59	11	soft hammer percussion, abrading	completed	Plate 29	Required a lot of work to finish.
11	quartzite	150	100	50	112	64	17	soft hammer percussion, abrading	complete	Plate 30	Still has major flaws in the toolstone
12	quartzite	118	103	42	93	51	12	soft hammer percussion, abrading	completed	Plate 30	Had to remove a lot of mass to complete.
13	quartzite	160	120	65	104	66	12	soft hammer percussion, abrading	completed	Plate 30	Broke within a few actions of finishing.
14	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
15	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Too many internal flaws to finish.

Table A.7: Results of Tertiary Stage Experiments

Cobble #	Material Type	Starting Measurements Length (mm)	Starting Measurements Width (mm)	Starting Measurements Thickness (mm)	Finished Measurements Length (mm)	Finished Measurements Width (mm)	Finished Measurements Thickness (mm)	Action(s)	Completed	Plate	Comments
16-a	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	soft hammer percussion, abrading	not completed		Failed at medial stage experiment.
16-b	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	soft hammer percussion, abrading	not completed		Failed at medial stage experiment.
17	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	soft hammer percussion, abrading	not completed		Failed at medial stage experiment.
18	quartzite	130	90	45	86	42	10	soft hammer percussion, abrading	completed	Plate 30	Had to remove a lot of mass to complete.
19	quartzite	120	85	30	109	54	17	soft hammer percussion, abrading	completed	Plate 30	Larger more robust version.
20	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		stopped at medial stage
21	quartzite	125	100	45	90	48	11	soft hammer percussion, abrading	completed	Plate 30	had to remove a lot of mass to complete
22	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
23	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
24	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
25-a	quartzite	140	90	25	120	64	17	soft hammer percussion, abrading	complete	Plate 30	Larger more robust version.
25-b	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
26-a	quartzite	100	60	20	99	51	14	soft hammer percussion, abrading	complete	Plate 28	Pressure flaking for platform preparation.
26-b	quartzite	110	90	25	110	70	21	soft hammer percussion, abrading	complete	Plate 29	Has a couple of step stacks that I wanted to remove.
27	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
28	quartzite	102	84	26	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
29	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.

Table A.7: Results of Tertiary Stage Experiments

Cobble #	Material Type	Starting Measurements Length (mm)	Width (mm)	Thickness (mm)	Finished Measurements Length (mm)	Width (mm)	Thickness (mm)	Action(s)	Completed	Plate	Comments
30	quartzite	110	85	20	106	68	16	soft hammer percussion, abrading	completed	Plate 28	Wanted to thin more but left as is.
31	quartzite	129	99	25	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
32	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
33	quartzite	90	80	20	89	60	18	soft hammer percussion, abrading	completed	Plate 29	Stalled along one edge but was able to finish.
34	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
35-a	quartzite	180	125	70	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
35-b	quartzite	140	100	40	112	71	16	soft hammer percussion, abrading	failed		Failed with only a few actions left.
35-c	quartzite	110	80	15	107	58	13	soft hammer percussion, abrading	completed	Plate 28	Did not thin as much as I wanted.
35-d	quartzite	140	100	20	129	61	16	soft hammer percussion, abrading	completed	Plate 29	
36	not quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at early stage.
37	quartzite	130	70	40	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
38	quartzite	120	100	30	n/a	n/a	n/a	soft hammer percussion, abrading	failed		Broke along internal flaw in the toolstone.
39-a	quartzite	160	140	60	n/a	n/a	n/a	soft hammer percussion, abrading	failed		
39-b	quartzite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
40-a	quartzite	n/a	90	n/a	n/a	n/a	n/a	n/a	not completed		Stopped at medial stage.
40-b	quartzite	100	100	30	n/a	n/a	n/a	soft hammer percussion, abrading	failed		Broke along internal flaw in the toolstone.

Table A.7: Results of Tertiary Stage Experiments

Number	Material Type	Starting Action	Type	Length (cm)	Width (cm)	Cross Section	Amount of Work to Finish to Embarras Bipoint	Comments
1	quartzite	untested cobble	cobble	14	12	bi-plano	major	
2	quartzite	untested cobble	cobble	13	11	bi-plano	major	
3	quartzite	tested cobble	cobble	13	8	bi-plano	major	
4	quartzite	bipolar	spall	11	10	cresentic	minimal	action completed prior to experiment
5	quartzite	"monkey"	spall	5	17	plano-convex	minimal	refits with 28, completed prior to experiment
6	quartzite	"monkey"	spall	13	12	plano-convex	minimal	action completed prior to experiment
7	quartzite	tested cobble	cobble	12	11	bi-plano	major	
8	quartzite	tested cobble	cobble	18	12	plano-convex	major	
9	quartzite	untested cobble	cobble	12	9	bi-plano	major	
10	quartzite	"monkey"	spall	19	13	triangular-convex	minimal	action completed prior to experiment
11	quartzite	"monkey"	core	19	11	spherical	major	
12	quartzite	bipolar	spall	12	12	plano-convex	minimal	action completed prior to experiment
13	quartzite	bipolar	cobble	18	12	plano-convex	minimal	action completed prior to experiment
14	quartzite	tested cobble	cobble	14	10	plano-convex	major	
15	quartzite	"monkey"	spall	11	9	plano-convex	minimal	
16	quartzite	untested cobble	cobble	14	13	spherical	major	
17	quartzite	"monkey"	core	16	10	bi-plano	minimal	
18	quartzite	bipolar	cobble	13	9	plano-convex	minimal	

Table A.8: Primary Data on Cobbles Used in the Experiments

Number	Material Type	Starting Action	Type	Length (cm)	Width (cm)	Cross Section	Amount of Work to Finish to Embarras Bipoint	Comments
19	quartzite	"monkey"	spall	15	12	plano-convex	minimal	
20	quartzite	"monkey"	spall	12	15	wedge-like	minimal	
21	quartzite	untested cobble	cobble	13	11	bi-plano	major	
22	quartzite	"monkey"	core	16	12	rectangular	major	
23	quartzite	"monkey"	spall	18	12	plano-convex	minimal	
24	quartzite	untested cobble	cobble	14	12	bi-plano	major	
25	quartzite	untested cobble	cobble	15	10	bi-plano	major	
26	quartzite	untested cobble	cobble	13	11	bi-plano	major	
27	quartzite	untested cobble	cobble	19	12	rectangular	minimal	action completed prior to experiment
28	quartzite	"monkey"	spall	13	16	plano-convex	minimal	refits with 5, action completed prior to experiment
29	quartzite	untested cobble	cobble	19	13	elliptical	major	
30	quartzite	"monkey"	spall	11	9	plano-convex	minimal	action completed prior to experiment
31	quartzite	natural spall	spall	13	15	plano-convex	minimal	
32	quartzite	natural spall	spall	12	11	bi-plano	minimal	
33	quartzite	natural spall	spall	10	10	bi-plano	minimal	
34	quartzite	tested cobble	cobble	19	13	bi-plano	major	
35	quartzite	untested cobble	cobble	20	13	elliptical	major	
36	quartzite	tested cobble	cobble	19	14	spherical	major	
37	quartzite	untested cobble	cobble	13	9	spherical	major	

Table A.8: Primary Data on Cobbles Used in the Experiments

Number	Material Type	Starting Action	Type	Length (cm)	Width (cm)	Cross Section	Amount of Work to Finish to Embarras Bipoint	Comments
38	quartzite	"monkey"	core	17	12	spherical	major	
39	quartzite	untested cobble	cobble	21	15	spherical	major	
40	quartzite	tested cobble	cobble	11	11	plano-convex	major	

Table A.8: Primary Data on Cobbles Used in the Experiments

Appendix B:
Descriptions of Embarras Bipoints

This appendix is the descriptions for each of the Embarras Bipoints that were included in this thesis. The descriptions are incomplete and focus mostly on the characteristics that are unique to Embarras Bipoints. The descriptive terms used to identify morphological features on Embarras Bipoints can be seen in Figure B.1.

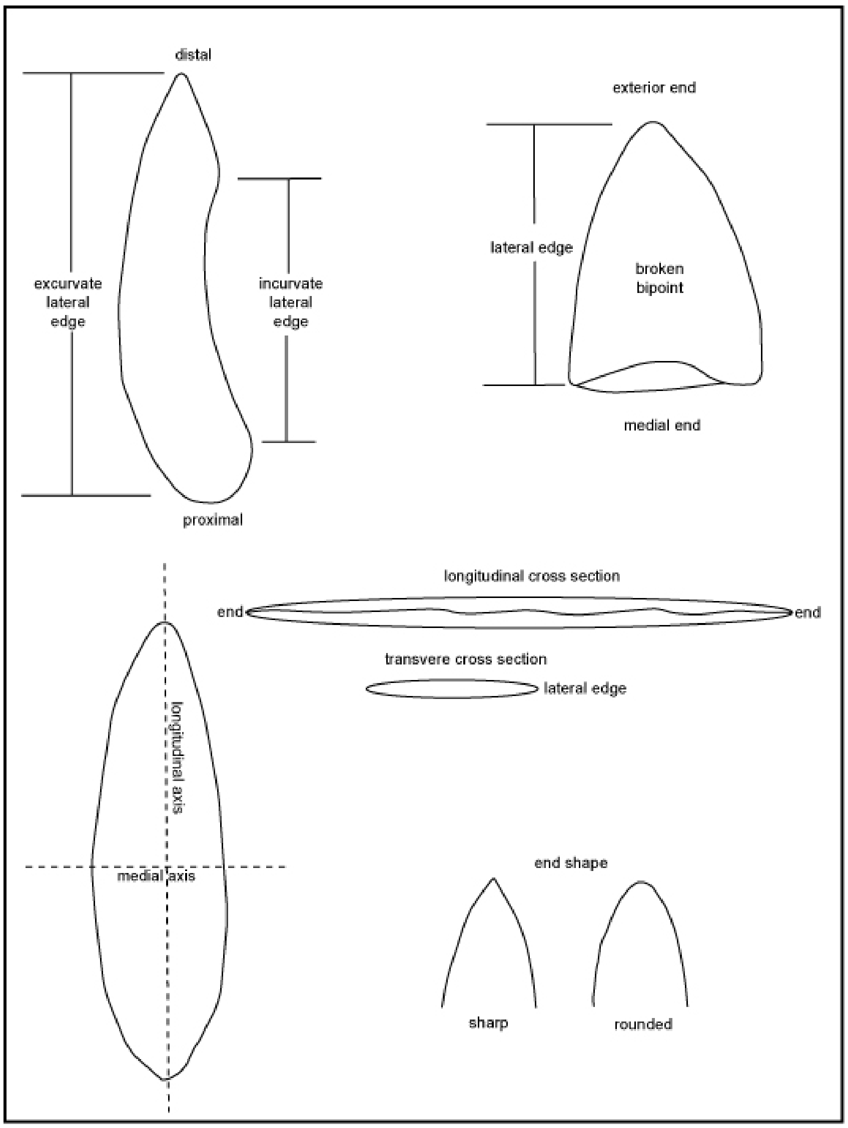

Figure B.1: Descriptive Markers on Embarras Bipoints

DgPl-85 (Plate 17; Table A.1.)

This excellent specimen of an Embarras Bipoint made of grey quartzite has a clear and obvious bipointed planview shape. The dorsal surface, as seen in the photograph, has a wide, random pattern of large comedial flake scars. The lateral edges are excurvate and they appear slightly sinuous (Reeves 1972:79-80, 181, 446). According to Reeves (2004, personal communication) this specimen is identical to the Embarras Bipoint found at EgPm-179-1437.

DjPp-2 (Table A.1.)

This potential Embarras Bipoint with all of the visible characteristics of other Embarras Bipoints was found in Level 1 along with a Lusk point, which means one of these artifacts was out of context. However, three (3) Bitterroot Side-Notched points, one (1) Salmon River Side-Notched point, and one (1) McKean Lanceolate point were recovered in Level 2 providing a more appropriate temporal context for this Embarras Bipoint (Reeves 1974:49, 64). The artifact appears to be made from quartzite. The shape is asymmetric but within in the range of shapes for Embarras Bipoints. The surface shown in Plate VI may be the ventral surface while the lateral edges appear sinuous and the body bears random, percussion edge flaking with the medial portion unmodified.

EgPr-2-362, 1035, 5856, 5964, and 6072 (Plate 17; Table A.1.)

At the Sibbald Creek Site there are at least five specimens that could be Embarras Bipoints. All of these have the requisite size, shape, and toolstone, as well as, similar associated projectile point types to other sites with Embarras Bipoints. All of the Embarras Bipoints are made from quartzite. Each of the artifacts appears to have a wide, random, comedial, percussion flaking pattern on the dorsal surface. The images of artifacts #6072, and #362 may be of the ventral surface and they appear to be less modified, exhibiting original spall surface, than the others showing the dorsal surface. All of these artifacts, except #6072, appear to have sinuous lateral edges. Two of the artifacts #5856 and 6072 were recovered within the block excavation, between 20 and 30 cm below the surface. At that same depth, within the block excavation, six Oxbow projectile points, and one Mount Albion projectile point were discovered. Also, between 10 and 20 cm a Reverse Uniface was recovered (Gryba 1983:58-63, 99, 102-103).

EgPm-179-1437 (Plate 8; Table A.1.)

This exceptional specimen of a complete Embarras Bipoint made from a grey quartzite has a bipointed planview shape and a bi-convex transverse cross section. The dorsal surface has wide, random, comedial percussion flaking followed by edge flaking to straighten the edges. The ventral surface has wide, random percussion flaking while edge flaking has straightened the edges. The medial portion of the ventral surface is unmodified (Van Dyke and Stewart 1985:26, 137, 218). Also, "Component 1, contains an incongruent occurrence of a Salmon River Side Notched projectile point in association with the Lusk point and a finely made, large bipointed biface. This is explained here, however, as a transitional component between the Plains/Mountain and the Mummy Cave complexes" (Van Dyke and Stewart 1985:137).

FfQm-26/191R1A2-8 (Table A.1.)

This artifact has no photograph or drawing but the written description is very intriguing. According to Pickard, this artifact, made from light grey quartzite, "is a large bi-pointed tool formed on a flake. The ventral surface is primarily unmodified. [….] The dorsal surface is randomly percussion flaked. [.…] This example is plano-convex in longitudinal cross section and biconvex in transverse cross-section. The biface is asymmetric with a right lateral skew" (Pickard 1985:16). The three projectile points found with this bipoint are good examples of Early Middle Period projectile points with one being called a Side-Notched point and the other two Large Stemmed points (Pickard 1985:14-15, 77).

Even though there is no photograph of this bipointed tool, there are several strong corroborating arguments that can be used to identify this as an Embarras Bipoint. FfQm-26 is to the northwest of the town of Jasper which is within what can be considered my study area. Also, Pickard succinctly describes the tool as a 'bipoint'; as well, the description of the reduction sequence and the toolstone are all very common attributes for other Embarras Bipoints.

FgQe-14-4107 (Plate 11; Table A.1.)

This small broken green quartzite Embarras Bipoint has a rounded trapezoidal planview shape and a bi-convex transverse cross section. The medial edge has a snap fracture. The lateral edges are slightly excurvate, converging towards the exterior end. The exterior end may be slightly more rounded than most Embarras Bipoints but the other technological traits are consistent. The dorsal surface has wide, random, comedial percussion flaking. The ventral surface has wide, percussion edge flaking with the medial portion left unmodified. The lateral edge and exterior end appear to have edge rounding that could be use-wear related. There was a Lovett Uniface, Erith Knife, Salmon River Side-Notched, and an unnotched Oxbow point found with this tool (Calder and Reeves 1977:10-12, 32, 43). FgQe-14 is similar to, "excavated sites in the southern Alberta Rockies, which are associated with the 'Mummy Cave Cultural Complex" (Calder and Reeves 1977:32).

FgQe-16-289 (Plate 1; Table A.1.)

This exquisite complete Embarras Bipoint, made from grey fine-grained quartzite, has a bipointed planview shape and a bi-convex transverse cross section. The distal end has been shaped to a sharp point. The lateral edges are excurvate. The proximal end is pointed to slightly rounded. The dorsal surface has wide, random, comedial percussion flaking. The ventral surface has wide, random, percussion edge flaking with the area around the left, ventral, lateral edge being mostly unmodified. There does not appear to be any obvious use-wear associated with this complete tool. A Lovett Uniface (FgQe-16-383), was found with this specimen. According to Calder and Reeves (1977:8) FgQe-16 is associated with the Mummy Cave Complex. More specifically they state, when discussing this Embarras Bipoint that, "similar bifaces occur in sites at Waterton Lakes, and in the Kananaskis Valley. They are associated with Bitterroot and Lusk point forms" (Calder and Reeves 1977:13). Also, this Embarras Bipoint has an uncanny morphological and technological similarity to EgPm-179-1437 (Van Dyke and Stewart 1985:26, 137, 218).

FgQe-56-1 (Plate 11; Table A.1.)

This broken Embarras Bipoint, made from pink fine-grained quartzite, has a rounded triangular planview shape and plano-convex transverse cross section. The medial edge has a snap fracture, but there is another snap break along the lateral edge meaning this may be a radial fracture. The lateral edges are excurvate converging towards the exterior tip. The dorsal surface has a wide, random, comedial, percussion flaking pattern. The ventral surface has a less intense wide, random, comedial, percussion flaking pattern. The remaining lateral edges are sinuous in appearance. A similar fracture pattern was found on FkQj-17-7 (Meyer 2003:418,424).

FgQf-16-141 (Plate 18; Table A.1.)

This complete Embarras Bipoint, made from light blue fine-grained quartzite, has a bipointed planview shape and a biconvex transverse cross section. Both the proximal and distal ends have been shaped into points, one more so than the other. The dorsal surface has large, comedial, random, percussion flaking. The ventral surface has wide, random, percussion edge flaking with the medial portion left unmodified. The lateral edges are sinuous. This artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-1000 (Plate 18; Table A.1.)

This broken portion of an Embarras Bipoint made from a pink fine-grained quartzite, has an asymmetric triangular planview shape and a plano-convex transverse cross section. The exterior tip is rounded to asymmetrically pointed, sharp and bifacially flaked. One lateral edge is excurvate and the other is straight. The body has wide, random, comedial, percussion flaking on the dorsal side and wide, percussion, but mostly edge flaking on the ventral. The medial end has a perverse fracture, with three small intrusive flakes perpendicular to the fracture on the dorsal surface. There are no obvious signs of use-wear on this broken tool. This artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-1001 (Plate 19; Table A.1.)

This medial portion of an Embarras Bipoint, made from pink fine-grained quartzite with a white, coarse grained vein in the toolstone, has a trapezoidal planview shape and a bi-convex transverse cross section. The shorter medial end has a concave shaped snap fracture that may be related to end shock. One lateral edge is excurvate and the other is straight. The body has random, comedial, bifacial percussion flaking with a greater intensity of flaking on the dorsal surface. The wider medial end has a perverse fracture. This broken tool has the same fracture pattern as FgQf-16-1020. This artifact tested positive for rabbit and this artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-1013 (Plate 19; Table A.1.)

This broken tool made from grey fine-grained quartzite has a semi-ovate planview shape and a bi-convex transverse cross section. The distal end is pointed, sharp and bifacially flaked. The lateral edges are straight to slightly excurvate converging towards the point. The medial edge has two obtuse angled snap fractures, consistent with a radial break. The body has comedial, random percussion flaking on the dorsal surface and large percussion edge flaking on the ventral surface. Clearly the dorsal surface of the body is more intensely flaked than the ventral. The two obtuse snap fractures on the medial edge indicate a perpendicular impact to the body or a bending force. This artifact tested positive for Bovine. This artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-1020 (Plate 19; Table A.1.)

This medial portion of an Embarras Bipoint, made from dark green quartzite, has a rhomboidal planview shape and a plano-convex transverse cross section. The wider medial edge has an irregular snap fracture associated with internal flaws within the toolstone. The opposite medial edge has a concave fracture that could be an end shock fracture. The lateral edges are excurvate. The dorsal surface has scars of large, random, wide percussion flaking and the ventral surface has less intense large, wide, random, percussion flaking. The fracture pattern on this tool is very similar to the fracture pattern on FgQf-16-1001. This artifact tested positive for Bovine and was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-1034 (Plate 20; Table A.1.)

This broken bifacial tool, made from grey quartzite, has a triangular planview shape and a plano-convex transverse cross section. The exterior point, which could be either the proximal or distal end, is sharp and bifacially percussion flaked. The lateral edges are slightly excurvate to straight converging towards the point. The body has a random, bifacial, percussion flaking pattern. The medial edge has a perverse fracture. At the right ventral medial juncture the lateral edge has platform preparation scarring and a partially initiated flake. This, in conjunction with edge sharpness, and no obvious signs of use-wear indicate that this tool broke during the manufacturing process. This artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-16-2270 (Plate 20; Table A.1.)

This broken Embarras Bipoint, made from grey fine-grained quartzite, has a rounded asymmetric triangular planview shape and a plano-convex transverse cross section. The proximal end is rounded and bifacially flaked. The lateral edges are excurvate and there is a unifacial concavity on the right, dorsal, lateral edge near the proximal end. The body has a large, random, comedial, percussion flaking pattern on the dorsal surface and wide percussion flaking on the ventral surface with an unmodified area along the longitudinal axis. Also, the ventral surface has small edge flaking that is consistent with unidirectional platform preparation with an abrader. The distal end has a snap fracture that may be related to a small step stack near the right, dorsal, lateral edge. The fracture pattern could indicate that this artifact broke during the manufacturing process. This artifact was found with a number of Embarras Bipoints, Reverse Unifaces, and Early Middle Period projectile points (Meyer and Roe n.d.).

FgQf-62-1471 (Plate 1; Table A.1.)

This complete Embarras Bipoint, made from white fine-grained quartzite, has a bipointed planview shape and a bi-convex transverse cross section. The proximal and distal ends are pointed to slightly rounded and bifacially flaked. The lateral edges are excurvate and sinuous. The dorsal surface has evidence of wide, random, comedial, large percussion flaking. The ventral surface has large, random, wide percussion edge flaking with a portion of the medial area left unmodified (Meyer et al. 2002b:81, 82, 84, 187-190). The technological similarities between this tool and FgQf-16-141 are astonishing. This specimen tested positive for Caribou (Meyer et al. 2002b:82) and interestingly, “the presence of caribou might indicate that the site dates to the later portion of the Nezu/Cody Complex [9,500 to 8,500 years before present] range in the area” (Ibid. :84). However, there are two issues with this Nezu/Cody Complex interpretation; first it was based upon the presence of a Nezu Knife, which after further examination could be a Lovett Uniface, and second it was done prior to the identification and recognition of Embarras Bipoints being related to the Early Middle Period

FgQf-90-1 (Plate 11; Table A.1.)

This uniquely broken Embarras Bipoint, made from dark green quartzite, has an elliptical planview shape and a plano-convex longitudinal cross section. The medial edge has a snap-hinge fracture along the longitudinal axis. The lateral edge is excurvate and slightly sinuous. The dorsal surface has wide, random, possibly comedial, percussion flaking. The ventral surface has wide, percussion edge flaking. The medial portion is unmodified on the ventral surface. Portions of the lateral edge appear to be ground and this could be related to platform preparation. There do not appear to be any other obvious signs of use-wear on this tool (Meyer 2003:418,424).

FgQf-131-1 (Plate 12; Table A.1.)

This broken Embarras Bipoint, made from blue/grey banded quartzite, has an asymmetric rounded triangular planview shape and a bi-convex transverse cross section. The medial edge has a perverse fracture. The lateral edges are excurvate converging towards the exterior point. The exterior point is rounded. The dorsal surface exhibits wide, random, comedial, percussion flake scarring. The ventral side has less intense wide, random, comedial, percussion flaking. There does not appear to be any use-wear on this broken tool. Another Embarras Bipoint, FgQf-131-3, was found with this artifact (Meyer 2003:418, 23).

FgQf-131-3 (Plate 12; Table A.1.)

This broken Embarras Bipoint, made from light grey fine-grained quartzite, has an asymmetric triangular planview shape and a plano-convex transverse cross section. The medial edge has a snap fracture that appears to be associated with an internal flaw in the tools stone. The right, dorsal, lateral edge is straight and converges towards the exterior point. The opposite lateral edge is excurvate converging towards the exterior point. The dorsal surface has a wide, random, comedial, percussion flaking pattern. The right, ventral, lateral edge has percussion edge flaking. The opposite appears to have platform preparation grinding on the edge. The majority of the ventral surface is unmodified. This broken Embarras Bipoint was found with FgQf-131-1 (Meyer 2003: 416, 425-426). The overall shape and size of this artifact is very similar to FhQf-10-1065 and 339.

FgQf-141-26 (Plate 12; Table A.1.)

This mostly complete Embarras Bipoint, made from light grey fine-grained quartzite, has an oval shape and a plano-convex transverse cross section. The medial end has an irregular snap fracture associated with internal flaws in the toolstone. The lateral edges are parallel, straight and converge towards the exterior end. The exterior end, possibly the proximal end, is rounded. The dorsal surface has wide, random, comedial, percussion flaking. The ventral surface has wide, percussion flaking, mostly on the left, ventral, side. The lateral edges have a sinuous appearance. There are several spots on the lateral edges that appear to have platform preparation flaking and grinding. There are no obvious signs of use-wear on this tool (Meyer 2004:455, 460). Another Embarras Bipoint was recovered from this site, FgQf-141-27.

FgQf-141-27 (Plate 11; Table A.1.)

This broken Embarras Bipoint, made from light grey fine-grained quartzite, has an asymmetric rounded triangular planview shape and a plano-convex transverse cross section. The medial edge has an angled snap fracture. The lateral edges are slightly excurvate to straight and converge towards the exterior point. The point is rounded. The dorsal surface has random, comedial, percussion flaking. The ventral surface has large, random, percussion edge flaking. The medial portion on the ventral side is unmodified. The lateral edges are slightly sinewy. There does not appear to be any obvious use-wear on this tool. Another Embarras Bipoint, FgQf-141-26, was found with this tool (Meyer 2004:455, 463). This specimen is similar in size and shape to FgQf-131-3, FhQf-10-339 and FhQf-10-1065.

FgQf-143-1 (Plate 12; Table A.1.)

This broken Embarras Bipoint, made from grey and tan fine-grained quartzite, has a triangular planview shape and a bi-convex transverse cross section. The medial edge has a perverse fracture. The lateral edges are excurvate, converging towards the exterior point. The exterior end is pointed to slightly rounded. The dorsal surface has wide, random, comedial, percussion flaking. The ventral surface has wide, percussion, edge flaking with the medial portion of the ventral surface left unmodified (Meyer 2004: 454,463). Another complete Embarras Bipoint, FgQf-143-4 was found in association with this tool.

FgQf-143-4 (Plate 2; Table A.1.)

This complete Embarras Bipoint, made from grey fine-grained quartzite, has a bipointed planview shape and a bi-convex transverse cross section. The distal end is sharp and pointed. The lateral edges are excurvate. The proximal end is pointed. The dorsal surface exhibits a wide, large, random, comedial, percussion flaking pattern. The ventral surface has wide, random percussion flaking with the medial portion unmodified (Meyer 2004:454,460). This tool tested positive for rabbit (Meyer 2005:496). Another broken Embarras Bipoint, FgQf-143-1 was found with this tool.

FgQg-17-6 (Plate 13; Table A.1.)

This broken Embarras Bipoint, made from light grey fine-grained quartzite, has a rounded triangular planview shape and a bi-convex transverse cross section. The medial edge has a perverse fracture, which may be related to an internal flaw in the toolstone. The lateral edges are excurvate converging toward the exterior point. The lateral edges are not sinuous but fairly straight and sharp. The point, that could be either the proximal or distal end, is rounded. The dorsal surface has flake scarring that is wide, random, comedial, and made by percussion. The ventral surface has wide, percussion edge flaking. There are no obvious signs of use-wear on this tool (Meyer 2004:455,463-464).

FhQf-10 Embarras Bipoints

The excavation of FhQf-10 led to the recovery of 13 complete and broken Embarras Bipoints. Each of the tools will be described individually because the tools were seen in-hand. At FhQf-10 there were a number of Early Middle Period projectile points found, as well as a Reverse Uniface (FhQf-10-2), and a Lovett Uniface (FhQf-10-7) (Hunt 1982).

FhQf-10-3 (Plate 2; Table A.1.)

This mostly complete Embarras Bipoint, made from light grey fine-grained quartzite, has a bipointed planview shape and a bi-convex transverse cross section. The distal end is pointed to slightly rounded and skewed. The lateral edges are excurvate. The proximal end is more rounded than the distal end and has a small snap fracture concavity on the right, dorsal, side. The lateral edges are sinuous in longitudinal cross section. The dorsal surface shows a wide, random, and large percussion flaking pattern. The ventral surface has wide, random, percussion flaking with the medial portion left unmodified. The sinuous lateral edges are slightly rounded indicating that this tool may have been used (Hunt 1982:98; Ronaghan and Reeves 1981:2, plate 1).

FhQf-10-44 (Plate 13; Table A.1.)

This large broken Embarras Bipoint, made from dark grey fine-grained quartzite, has a rounded triangular planview shape and a bi-convex transverse cross section. The medial edge has a snap fracture. The lateral edges are excurvate and converge towards a skewed exterior point. The dorsal surface has a wide, random, comedial, percussion flaking pattern. The ventral surface has wide, percussion edge flaking. The left, ventral, lateral edge has a concave-shaped snap fracture. The lateral edges are not as sinuous as other Embarras Bipoints. The right, dorsal, lateral edge may have been utilized (Hunt 1982:96; Ronaghan and Reeves 1981:1-2, Plate 1).

FhQf-10-45 (Plate 11; Table A.1.)

This broken Embarras Bipoint, made from purple fine-grained quartzite, has a rhomboidal planview shape and a plano-convex transverse cross section. The medial edge has a perverse fracture. The exterior point is rounded. The lateral edges are slightly excurvate to straight converging towards the exterior point. The dorsal surface has wide, random, comedial, percussion flaking. The ventral surface has percussion edge flaking with at least two related hinge terminations. The medial portion of the ventral surface is unmodified. The lateral edges are mostly straight but some is sinuous in appearance (Hunt 1982:102).

FhQf-10-339 (Plate 13; Table A.1.)

This broken Embarras Bipoint, made from dark grey fine-grained quartzite, has a triangular planview shape and a bi-convex transverse cross section. The lateral edges are sinuous in longitudinal cross section. The body exhibits a wide, random, comedial, bifacial, percussion flaking pattern. The medial edge has a snap-hinge fracture. The lateral edges appear to have a moderate amount of edge grinding that may be use-wear or possibly platform preparation scarring. The flaking is slightly different but the shape, size, toolstone, and lateral edge morphology is consistent with other Embarras Bipoints (Hunt 1982:102). This artifact is very similar in size and shape to FhQf-10-1065, FgQf-131-3, FgQf-141-27, FjQk-24-1, and FkQj-9-36.

FhQf-10-912 (Plate 3; Table A.1.)

This complete Embarras Bipoint, made from light grey quartzite, has a rounded triangular planview shape and a bi-convex transverse cross section. The flaking is more concentrated on the dorsal surface with large, random, wide, percussion flaking. The ventral surface has wide, percussion edge flaking. The right, dorsal, lateral edge appears to be unfinished with a squared edge. The squared edge could be misinterpreted as a remnant striking platform from a large early secondary or secondary percussion spall. A similar feature was found on FhQf-10-1082. The lateral edges have random spots of edge grinding that is associated with platform grinding. The proximal end is not pointed but asymmetrically rounded indicating this specimen may not have been completed (Hunt 1982:Table 20).

FhQf-10-978 (Plate 3; Table A.1.)

This mostly complete Embarras Bipoint, made from light grey fine-grained quartzite, has mostly a bipointed planview shape and a bi-convex transverse cross section. The distal end has been shaped and flaked to a point. The lateral edges are excurvate. The proximal end has two obtuse-angled snap fractures consistent with a radial break. The dorsal surface has a wide, large, random, comedial, percussion flaking pattern. The ventral surface has wide, random, large percussion edge flaking where the medial portion is unmodified. The lateral edges are slightly sinuous when viewed in longitudinal cross section. There is not obvious use-wear associated with this tool (Hunt 1982:94, 97-98).

FhQf-10-1040 (Plate 4; Table A.1.)

This complete Embarras Bipoint, made from grey fine-grained quartzite, has a bipointed planview shape and a bi-convex transverse cross section. Both the proximal and distal ends are pointed to slightly rounded in profile. The lateral edges are excurvate and sinuous in appearance. The dorsal side has wide, random, percussion flake scarring with the medial portion left unmodified. The ventral surface has a similar flaking pattern, except one side has been left unmodified. One end, either the proximal or distal, is squared off and the overall flaking pattern is not intense indicating that this specimen was lost or discarded before being completed (Hunt 1982:97-98).

FhQf-10-1065 (Plate12; Table A.1.)

This broken Embarras Bipoint, made from light green quartzite, has a rounded triangular planview shape and a bi-convex transverse cross section. The dorsal surface is more intensely flaked with a wide, random, comedial, percussion flaking pattern. The ventral surface show signs of random, comedial, percussion flake scarring but not as intensely as the dorsal surface. The sinuous lateral edges exhibits a moderate amount of edge rounding that could be use-wear related. The medial edge has a perverse fracture (Hunt 1982:96-97). This artifact is very similar in size and shape to FgQf-141-27, FhQf-10-339, FgQf-131-3, FjQk-24-1, and FkQj-9-36.

FhQf-10-1082 (Plate 13; Table A.1.)

This broken Embarras Bipoint, made from light green fine-grained quartzite, has a trapezoidal planview shape and a bi-convex transverse cross section. The distal end has a perverse fracture. The medial edge has an internal flaw which may be why this tool broke during the manufacturing process. The dorsal surface exhibits a wide, random, comedial, percussion flaking pattern and the ventral side has wide, percussion, edge flake scarring. The lateral edges are sinuous when viewed in longitudinal cross section. The left, ventral, distal juncture has what appears to be a remnant striking platform from a large early secondary or secondary spall, but is more likely an incomplete portion of the lateral edge. A similar feature can be seen on FhQf-10-912. There are no obvious signs of use-wear on this tool (Hunt 1982:102).

FhQf-10-1210 (Plate 4; Table A.1.)

This extremely thin complete Embarras Bipoint, made from grey fine-grained quartzite, has an oval planview shape and a plano-convex transverse cross section. Both the proximal and distal ends are rounded and bifacially flaked. The lateral edges are excurvate. The dorsal side exhibits wide, random, large, comedial, percussion flake scarring. The ventral surface has a wide, random, percussion flaking pattern with the medial portion left unmodified. Along one lateral edge near the medial axis the piece broke in two. The snap fracture that refits the two pieces has one, possibly two, percussion flakes with hinge terminations that are related to the snap fracture. The roundness of the proximal and distal ends, the fracture pattern, and the recovery of both pieces of FhQf-10-1210 indicate that this piece may have been broken during the manufacturing process (Hunt 1982:93).

FhQf-10-1261 (Plate 5; Table A.1.)

This mostly complete Embarras Bipoint, made from grey and purple banded fine-grained quartzite, has an elliptical planview shape and a plano-convex transverse cross section. Both ends are rounded. The lateral edges are straight to slightly excurvate and are sinewy in cross section. The dorsal surface has a wide, random, comedial, percussion flaking pattern with one large step-stack feature near the longitudinal axis. The ventral surface has mostly edge flaking with larger random, percussion flaking on one end. There is a concave-shaped snap fracture on one lateral edge. Portions of the lateral edges are ground in a platform preparation fashion. The toolstone used for this artifact is almost identical to the toolstone used for FhQf-10-743 and 769, a potential refitted Embarras Bipoint preform, meaning the two artifacts could have been made from the same cobble. The morphological features present on this specimen indicate that it may have broken during the tertiary stage of the manufacturing process (Hunt 1982:96).

FhQf-10-1299 (Plate14; Table A.1.)

This small broken Embarras Bipoint portion, made from grey fine-grained quartzite, has a mostly ovate planview shape and a plano-convex transverse cross section. There is an angled snap fracture from the distal end towards the proximal end on the left, dorsal, lateral edge. The dorsal surface exhibits a wide, random, comedial, percussion flaking pattern. The ventral surface has wide, percussion edge flake scarring with some of the flakes having hinge terminations. The edges are slightly sinuous in longitudinal cross section. The proximal end on the dorsal side has some cortex. The lateral edges appear to have areas with edge grinding. There are no obvious signs of use-wear on this tool so the grinding on the edge, and the fracture on the distal end, may mean this tool broke during the manufacturing process (Hunt 1982:93).

FhQg-2-608 (Plate 5; Table A.1.)

This mostly complete, refitted, Embarras Bipoint, made from grey fine grained quartzite, has a bipointed planview shape and a plano-convex transverse cross section. The remnant distal end is pointed with two irregular snap-hinge terminations that have removed a portion of the right, dorsal lateral edge on the distal end. The lateral edges are excurvate. The proximal end has a pointed shape. The dorsal surface has a wide, random, large, comedial percussion flaking pattern. The ventral surface exhibits large, random, percussion flake scarring with the medial portion remaining unmodified. This specimen appears to have broken along natural flaws in the toolstone (Calder and Reeves 1978: 7, 31). Another possible Embarras Bipoint (FhQg-2-179), and an Embarras Bipoint (FhQg-2-609), was found with this artifact.

FhQg-2-609 (Plate 14; Table A.1.)

This mostly complete Embarras Bipoint, made from light grey quartzite, has a triangular planview shape and a plano-convex transverse cross section. The medial end has a perverse fracture. The lateral edges are excurvate converging towards the distal end. The distal end has a pointed to slightly rounded planview shape. The body on the dorsal side has wide, random, comedial, percussion flaking. The ventral surface exhibits wide, random, percussion edge flaking. The lateral edges are sinuous in cross section (Calder and Reeves 1978:8, 31). There does not appear to be any obvious use-wear on this tool. Another possible Embarras Bipoint (FhQg-2-179), and Embarras Bipoint (FhQg-2-6080), was found with this artifact.

FhQg-3-36 (Plate 6; Table A.1.)

This exceptionally thin complete Embarras Bipoint, made from grey fine-grained quartzite, has an ovate planview shape and a plano-convex transverse cross section. The distal end has edges that are sharp and a slightly rounded planview shape. The lateral edges are excurvate. The proximal end has a rounded appearance. The dorsal surface exhibits a wide, random, comedial, percussion flaking pattern. The ventral surface has percussion edge flaking on the left lateral edge towards the distal end and on the right lateral edge towards the proximal end. The lateral edges are sinuous in longitudinal cross section. There are portions of the lateral edges that were not flaked during the last round of flaking actions which are still ground. There are no other obvious signs of use-wear on this complete tool (Meyer 2003:416, 426).

FiQe-20-5 (Plate 9; Table A.1.)

This complete Embarras Bipoint made from red/pink fine-grained quartzite has a lanceolate planview shape and a bi-convex transverse cross section. Both the proximal and distal points are pointed to slightly rounded and bifacially flaked. The lateral edges in planview are excurvate and slightly wavy in cross section. The flaking pattern on the dorsal surface consists of wide, random, comedial, soft hammer percussion scarring. The ventral surface has a wide, random, soft hammer percussion flaking pattern with the medial portion along the longitudinal axis left unmodified. The form, material type, and visible reduction sequence is consistent with other known Embarras Bipoints within the region. This artifact tested positive for sheep (Meyer et al. 2008)

FiQi-1-1 (Plate 17; Table A.1.)

This complete Embarras Bipoint, made from fine-grained grey quartzite, has a bipointed planview shape. The side of the tool showing in the photograph (most likely the dorsal side) has a wide, random, comedial, percussion flaking pattern. According to McCullough (1982:37) this specimen, “is bifacially flaked along all of its edges”, and one can assume the ventral surface has an appropriate flaking pattern for an Embarras Bipoint. The lateral edges appear to be slightly sinuous (McCullough 1982:37-38). Another trait noticed on this artifact by McCullough was, “very little of the platform remains but enough is present to suggest that the biface was made on a large flaked or spall” (McCullough 1982:37). The appearance of a ‘remnant platform’ is common on some Embarras Bipoints. However, this ‘platform’ can be explained as a less modified lateral edge with transecting flake scarring from the opposite side creating the appearance of a platform-like feature. Also, this description mentions the use of a spall as the starting point for this tool which, discussed elsewhere in this thesis, is unlikely. Based on the photograph and description provided by McCullough this artifact because of its overall size, shape, toolstone, and visible flaking pattern are convincing traits making this an Embarras Bipoint.

FjQi-5-11 (Plate 14; Table A.1.)

This split Embarras Bipoint, made from light grey/tan fine-grained quartzite, has a bipointed planview shape and a bi-convex longitudinal cross section. The medial edge has a snap-hinge fracture. The lateral edge is excurvate and slightly sinuous. The dorsal surface of the body shows signs of wide, large, random, percussion flaking. The ventral surface has wide, percussion edge flaking with the medial portion left unmodified. A portion of the lateral edge towards one end has cortex and platform preparation edge grinding indicating that this tool may have broken during the manufacturing process. This fracture pattern is very similar to the fracture pattern for FgQf-90-1 (Meyer 2004:454, 464).

FjQl-46-9 (Plate 6; Table A.1.)

This mostly complete Embarras Bipoint, made from pink fine-grained quartzite, has an ovate planview shape and a bi-convex transverse cross section. The distal end is a rounded point. The right, dorsal, lateral edge is slightly excurvate with a step fracture that has removed a fragment of the edge. The opposite lateral edge is excurvate. The dorsal surface has a large, wide, random, comedial percussion flaking pattern. The ventral surface has wide, random percussion edge flaking. The edges are slightly sinuous. Portions of the right, dorsal, lateral edge has platform preparation edge grinding. There are no other obvious signs of use-wear on this tool (Meyer et al. 2008).

FjQk-7-1 (Plate 14; Table A.1.)

This exquisite but broken Embarras Bipoint, made from dark grey fine-grained quartzite, has a rounded triangular planview shape and a plano-convex transverse cross section. The medial end has two obtuse angled snap fractures consistent with a radial fracture. The lateral edges are excurvate and converge towards the rounded exterior tip. The dorsal surface exhibits wide, random, comedial, percussion flaking. The ventral surface has a minimal to moderate amount of edge flaking. The left, dorsal, lateral edge is more sinuous than the opposite lateral edge. There does not appear to be any obvious use-wear on this specimen (Meyer 2004:139, 464). A similar fracture pattern, i.e. radial, was found on FkQj-17-7.

FjQk-24-1 (Plate 14; Table A.1.)

This broken Embarras Bipoint, made from pink fine-grained quartzite, has an asymmetric triangular planview shape and a bi-convex transverse cross section. The medial edge has an angled snap-hinge fracture. The left, dorsal, lateral edge is straight and the opposite lateral edge is excurvate. The exterior point is sharp to slightly rounded in appearance. The body has a wide, comedial, bifacial, percussion flaking pattern. The right, dorsal, lateral edge is still squared off towards the exterior point. The edges are ground between the last round of percussion flakes taken off the dorsal surface. This artifact appears to have broken during the manufacturing process. This artifact is very similar in size and shape to FgQf-141-27, FhQf-10-1065 and 339, and FgQf-131-3, FkQj-9-36 (Meyer 2004:454, 464).

FkQj-9-36 (Plate 14; Table A.1.)

This broken Embarras Bipoint, made from grey fine-grained quartzite, has a triangular planview shape and a plano-convex transverse cross section. The medial edge has a snap fracture, which is possibly related to a radial fracture. The lateral edges are slightly excurvate to straight and converge towards the distal end. The distal end is sharp and pointed in appearance. The body has a wide, random, comedial, bifacial, percussion flaking pattern. The lateral edges are sinuous (Meyer 2004:454, 465). This artifact is very similar in size, shape, and flaking as FgQf-141-27, FhQf-10-339 and 1065, FgQf-131-3, and FjQk-24-1.

FkQj-11-32 (Plate 15; Table A.1.)

This broken Embarras Bipoint, made from light grey fine-grained quartzite, has a rounded rectangular planview shape and a bi-convex transverse cross section. The medial edge has a radial fracture that has also removed a portion of the right, dorsal, lateral edge. The left, dorsal, lateral edge in planview is straight. The opposite lateral edge, even with the radial fracture removing part of the edge, appears to be excurvate. The exterior end is sharp and rounded. The dorsal surface has wide, random, comedial, percussion flakes with a step stack feature towards the exterior end. The ventral surface has a wide, random, comedial percussion flaking pattern with an unmodified medial portion (Meyer 2004:455, 465). The fracture pattern is similar to ones found on FgQe-56-1, FkQj-7-7, FkQj-11-32, and FkQj-17-7.

FkQj-17-7 (Plate 15; Table A.1.)

This broken Embarras Bipoint, made from light grey fine-grained quartzite, has a rhomboidal planview shape and a plano-convex transverse cross section. The medial edge has a radial fracture with one snap fracture removing a portion of the right, dorsal lateral edge. The opposite lateral edge is excurvate and converges towards the exterior point. The exterior end is rounded. The dorsal surface exhibits wide, random, comedial percussion flake scarring. The ventral surface has large, random, predominantly percussion edge flaking. The medial portion of the ventral surface is unmodified. There are no obvious signs of use-wear on this tool, and the overall appearance of this tool indicates that it may have broken during the manufacturing process (Meyer 2004:455,465). A similar fracture pattern on the medial edge was found on FjQk-7-1.

FkQl-14-13 (Plate 16; Table A.1.)

This broken grey quartzite Embarras Bipoint (initially identified as an Erith Knife in Meyer and Roe 2006:542, 550), has a rounded scalene triangular planview shape and a plano-convex transverse cross section. This specimen is not an Erith Knife because of the flaking on the ventral surface. The medial end has a snap fracture. The exterior point in planview is rounded. The lateral edges are slightly excurvate to straight and converge towards the exterior point. The right, dorsal, lateral edge has a concave snap fracture associated with a hinge termination on the body. The ventral surface shows signs of wide, random percussion edge flaking with the majority of the ventral surface left unmodified. The lateral edges have edge grinding that appears to be part of the preparation actions for removing flakes from the dorsal surface and not use-wear related. This is an extremely well made tool, but appears to have been broken during the manufacturing process (Meyer and Roe 2006:542, 550).

FkQl-26-2 (Plate 7; Table A.1.)

This complete Embarras Bipoint, made from grey fine-grained quartzite, has an ovate planview shape and a plano-convex transverse cross section. The distal end has a pointed to rounded shape and has been unifacially flaked on the dorsal surface. The lateral edges are excurvate. The proximal end is rounded, moderately bifacially flaked, and has a squared off portion exhibiting cortex. The dorsal surface shows signs of wide, random, comedial, large, percussion flaking. The ventral surface has wide, random, percussion edge flake scarring. The right, dorsal, lateral edge near the medial axis has a stalled step stack. The cortex on the proximal edge, the stalled feature on the dorsal surface, and the overall size indicate that this tool may not have been completed or was only moderately used before being lost or discarded (Meyer et al. 2008:542, 550).

FlQh-12-1 (Plate 16; Table A.1.)

This broken Stage V biface portion, made from grey quartzite, has a rounded scalene triangular planview shape and a bi-convex transverse cross section. The exterior point is sharp to slightly rounded and bifacially flaked. The lateral edges are excurvate and wavy in cross section. The dorsal surface has a wide, random, comedial, soft hammer percussion flake pattern. The ventral surface shows signs of wide, random, soft hammer percussion edge flake scarring. The medial edge has a perverse fracture. The form, material type, and visible reduction sequence is consistent with other known Embarras Bipoints within the region (Meyer et al. 2008).

FlQh-12-2 (Plate 15; Table A.1.)

This broken Stage IV/V biface portion, made from pink fine-grained quartzite, has an ovate planview shape and a bi-convex transverse cross section. The exterior end is rounded in appearance and has been bifacially flaked. The lateral edges are slightly excurvate to straight and parallel. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern. The ventral surface has been modified by random, soft hammer percussion, edge flaking. The medial edge has an angled perverse fracture. The form, material type, and visible reduction sequence is consistent with other known Embarras Bipoints within the region (Meyer et al. 2008). This artifact is very similar to FhQf-10-1251 (Hunt 1982:99).

FlQh-12-3 (Plate 9; Table A.1.)

This complete Stage V biface, made from light grey fine-grained quartzite, has a mostly elliptical planview shape and a bi-convex transverse cross section. The distal end is pointed to slightly rounded in appearance and has been bifacially flaked. The lateral edges are excurvate. The dorsal surface shows signs of wide, random, comedial, soft hammer percussion flaking with a minor step stack along the longitudinal axis. The ventral surface has a wide, random, comedial, soft hammer percussion flaking pattern. The overall shape, material type, and size are consistent with known Embarras Bipoints in the region. One difference between this specimen and other Embarras Bipoints is the reduction sequence has more flaking on the ventral surface, but this appears to be more intensive flaking actions than a different chaîne opératoire. This artifact is very similar to FlQj-16-12. Also, this tool tested positive for Cervid or deer (Meyer et al. 2008).

FlQh-13-2 (Plate 15; Table A.1.)

This broken Stage IV/V biface portion, made from quartzite, has a rounded scalene triangular planview shape and a bi-convex transverse cross section. The exterior point is rounded in appearance and has been bifacially flaked. The remnant lateral edges are excurvate and slightly wavy in cross section. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern. The ventral surface shows signs of random, soft hammer percussion, edge flake scarring and the medial portion has been left unmodified. The medial edge has a slightly angled perverse fracture. The form, material type, and visible reduction sequence is consistent with other known Embarras Bipoints within the region (Meyer et al. 2008).

FlQh-13-3 (Plate 15; Table A.1.)

This broken Stage V biface portion, made from light grey very fine-grained quartzite, has a mostly ovate planview shape and a plano-convex transverse cross section. The exterior point is sharp and has been bifacially flaked. The lateral edges are excurvate and slightly wavy. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern with a step stack along the longitudinal axis. The ventral surface exhibits wide, random, soft hammer percussion edge flake scarring and the medial portion has been left unmodified. The medial edge has a radial fracture.   The form, material type, and reduction sequence is consistent with other known Embarras Bipoints within the region (Meyer et al. 2008). This artifact is very similar to FlQh-12-3 and FlQj-16-12.

FlQi-3-175 (Plate 10; Table A.1.)

This complete grey quartzite biface has an overall oval planview shape and a plano-convex transverse cross section. The proximal, distal, and lateral edges are sinuous in cross section and appear unfinished with cortex along one edge. The dorsal surface exhibits wide, comedial, percussion flake scarring and the opposite surface has some edge percussion flaking associated with the bulb of percussion. This tool looks to be incomplete but has been finished enough to be identified as an Embarras Bipoint (Meyer 2004: 454, 462).

FlQj-16-12 (Plate 16; Table A.1.)

This broken Stage V biface portion, made from light grey fine-grained quartzite, has a scalene triangular planview shape and a bi-convex transverse cross section. The exterior point is sharp to slightly round in appearance and has been bifacially flaked. The lateral edges are excurvate. The dorsal surface has a wide, random, comedial, soft hammer percussion flaking pattern. The ventral surface shows signs of random, soft hammer percussion, edge flake scarring and the medial portion has been left unmodified. The medial edge has an angled perverse fracture. The form, material type, and visible reduction sequence is consistent with other known Embarras Bipoints within the region (Meyer et al. 2008). This artifact is very similar to FlQh-12-3.

FlQj-29-2 (Plate 7; Table A.1.)

This complete Embarras Bipoint, made from dark grey fine-grained quartzite, has a rounded to bipointed planview shape and a plano-convex transverse cross section. Both the proximal and distal ends are rounded and have been moderately bifacially flaked. The dorsal surface exhibits a wide, random, comedial, large percussion flake scar pattern. The ventral surface has a wide, random percussion edge flaking pattern and the medial portion has been left unmodified. The lateral edges are sinuous in cross section. The right, ventral, lateral edge is squared off indicating that this piece may have been discarded or lost before being finished (Meyer et al. 2008).

GbPv-1-585 and 897 (Table A.1.)

These two complete quartzite specimens, based on the photographs and descriptions, have all the essential criteria for being Embarras Bipoints. They possess the requisite size, shape, and material type and have been described by Ronaghan and Hanna (1981:95-96, 107) as having, "roughly ovate bifaces with plano-convex cross section. Each specimen exhibits extensive retouch over most of the dorsal surface but only marginal finishing upon the ventral surface". The photograph, a photocopy of a black and white photograph, shows only the planview profile but the shape of the tool and the succinct description of the tools are convincing arguments for these two artifacts being Embarras Bipoints.

North Star Road, surface find (Plate 8; Table A.1.)

This complete Embarras Bipoint, found on the surface near the hamlet of Mercoal by R. Ronaghan and L. Lefluer of C.V.R.I., has been made form pink fine-grained quartzite. The specimen has an ovate planview shape and a plano-convex transverse cross section. The distal end is rounded to a point. The lateral edges are excurvate. The proximal end is round and wider than the distal end. The dorsal surface exhibits wide, large, random, comedial, percussion flake scarring. The ventral surface has a wide, random percussion edge flaking pattern. The lateral edges are slightly sinuous in cross section. Portions of the lateral edges appear to have platform preparation grinding meaning the tool may be unfinished. This complete tool is very similar to FgQf-16-141 and FgQf-62-1471.

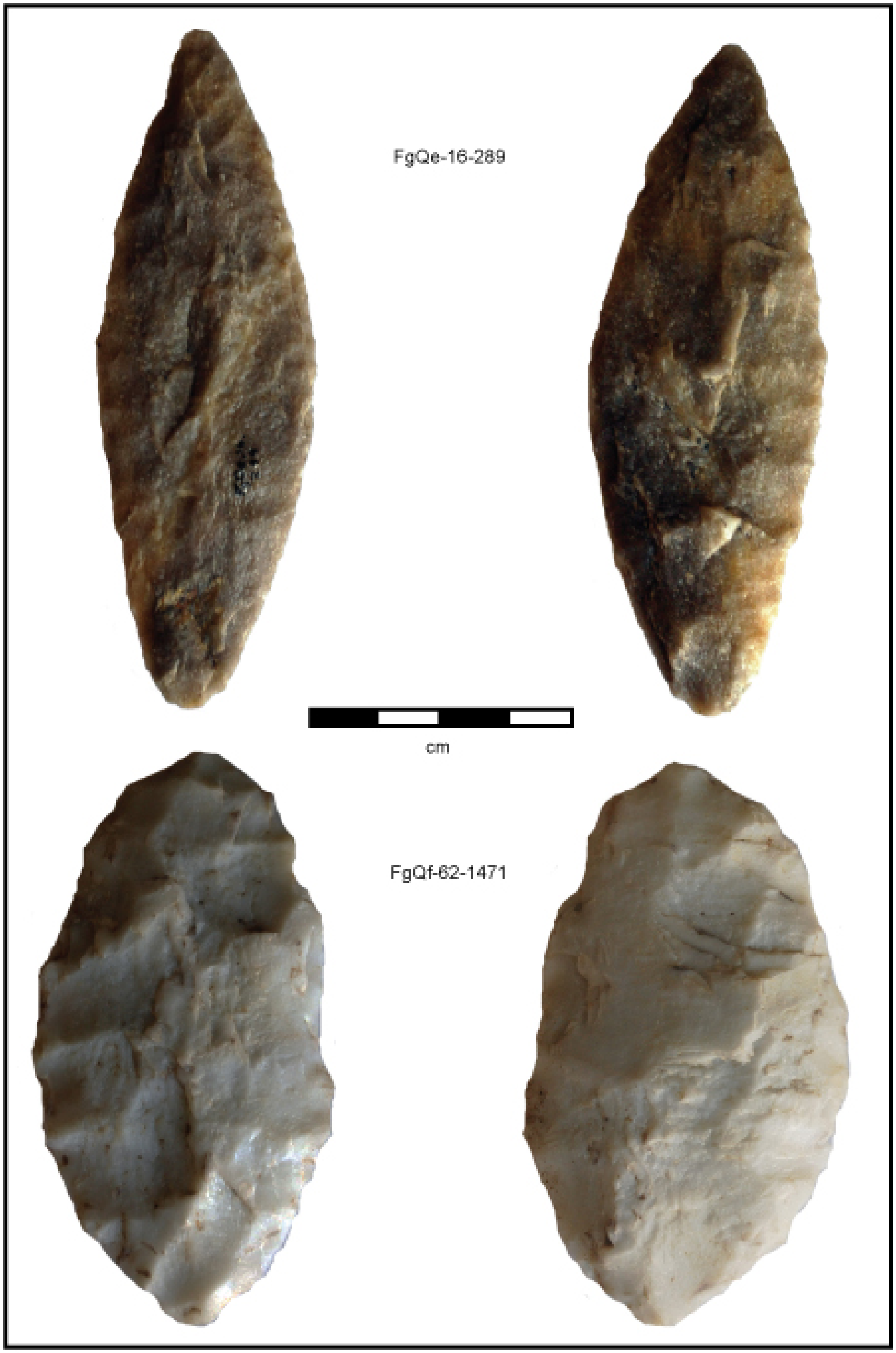

Plate 1: Complete Embarras Bipoints

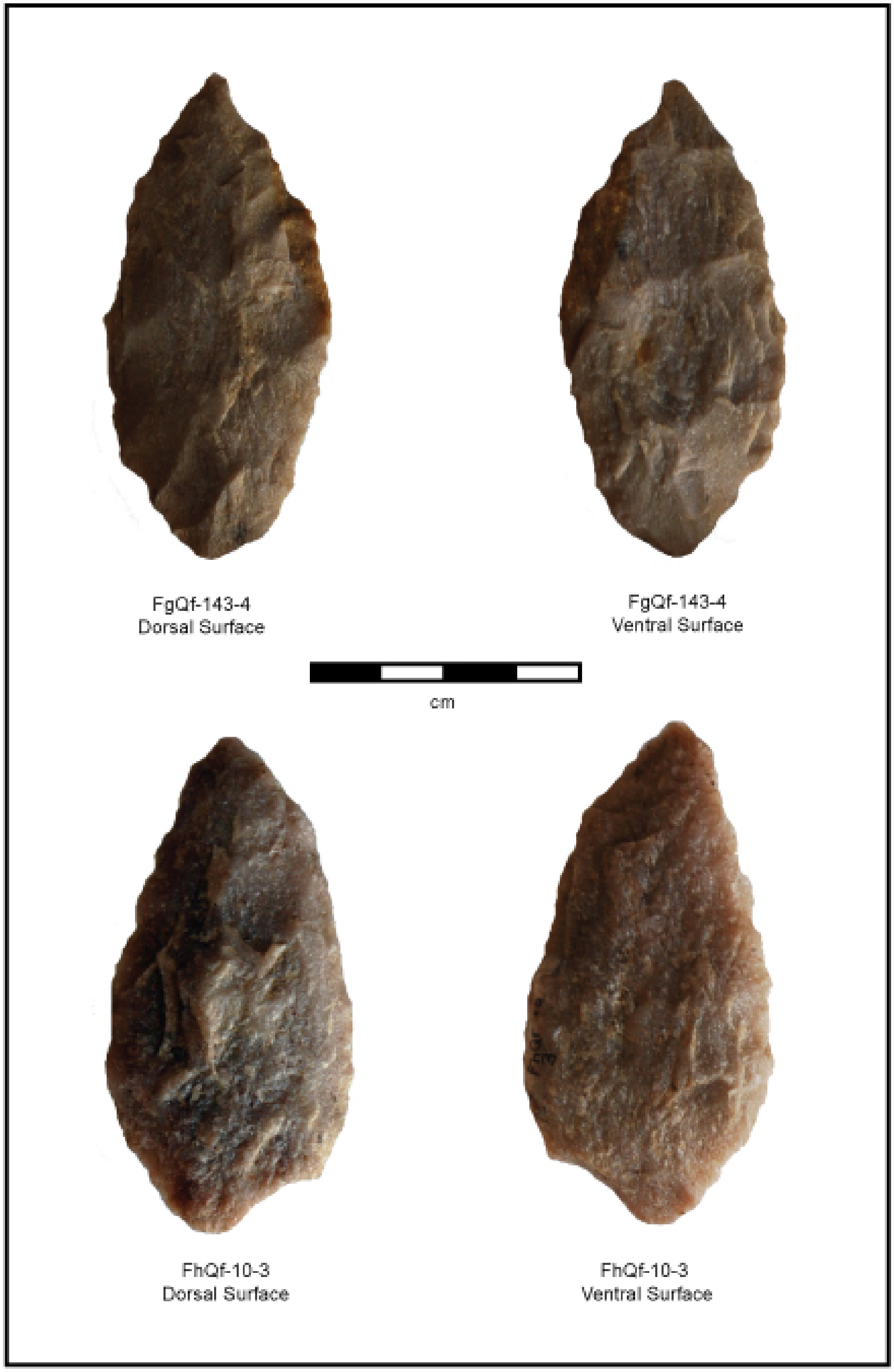

Plate 2: Complete Embarras Bipoints

Plate 3: Complete Embarras Bipoints

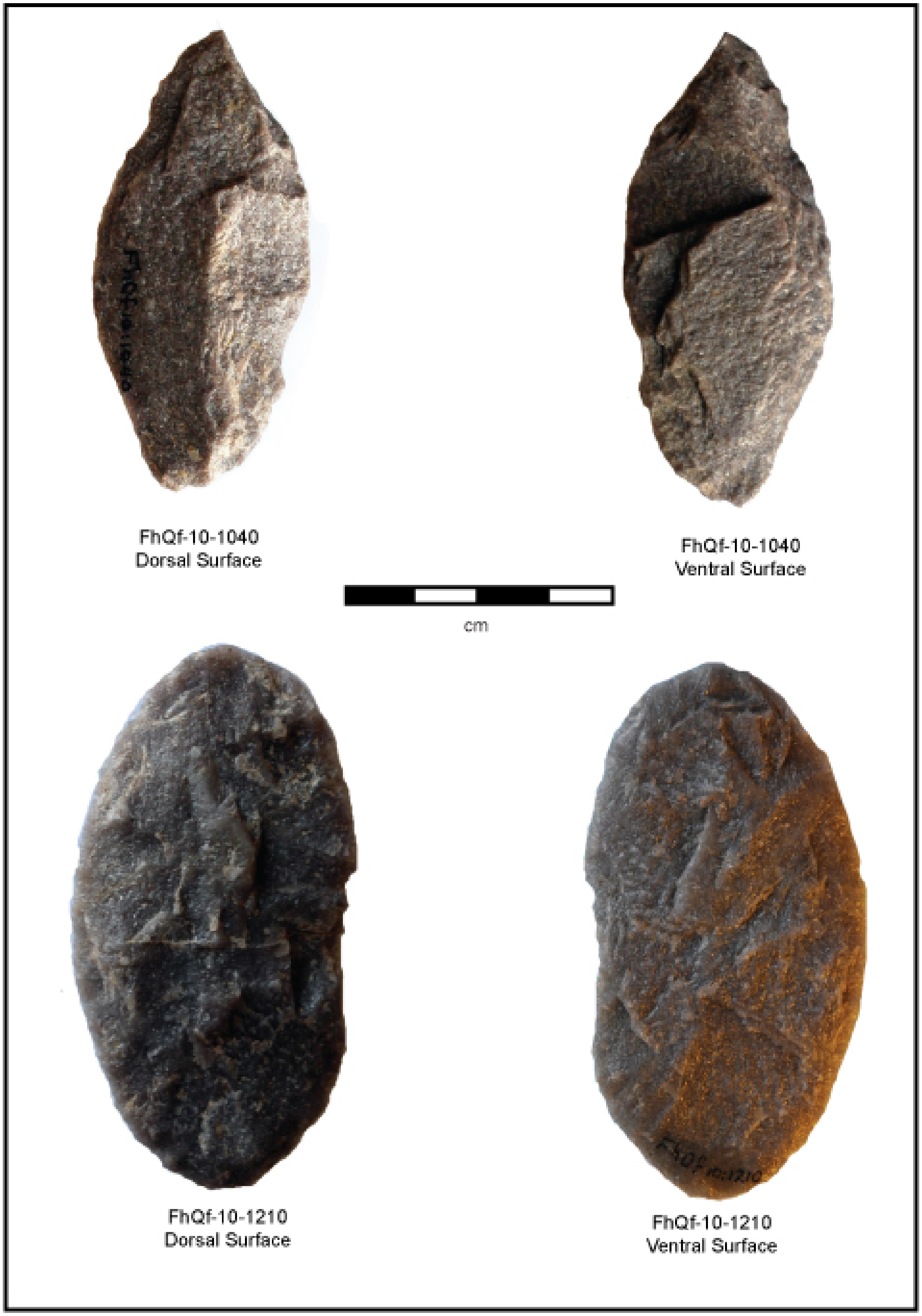

Plate 4: Complete Embarras Bipoints

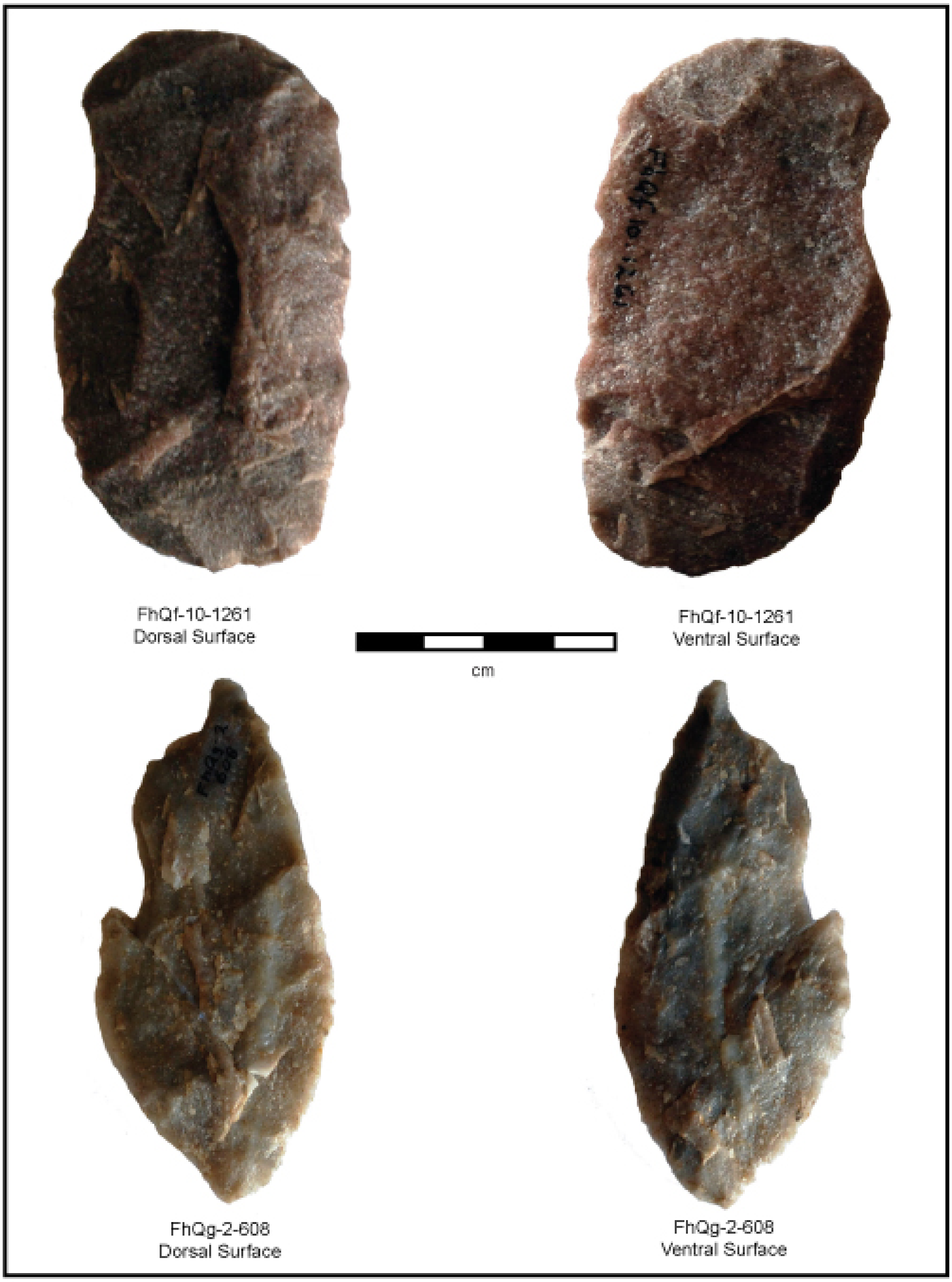

Plate 5: Complete Embarras Bipoints

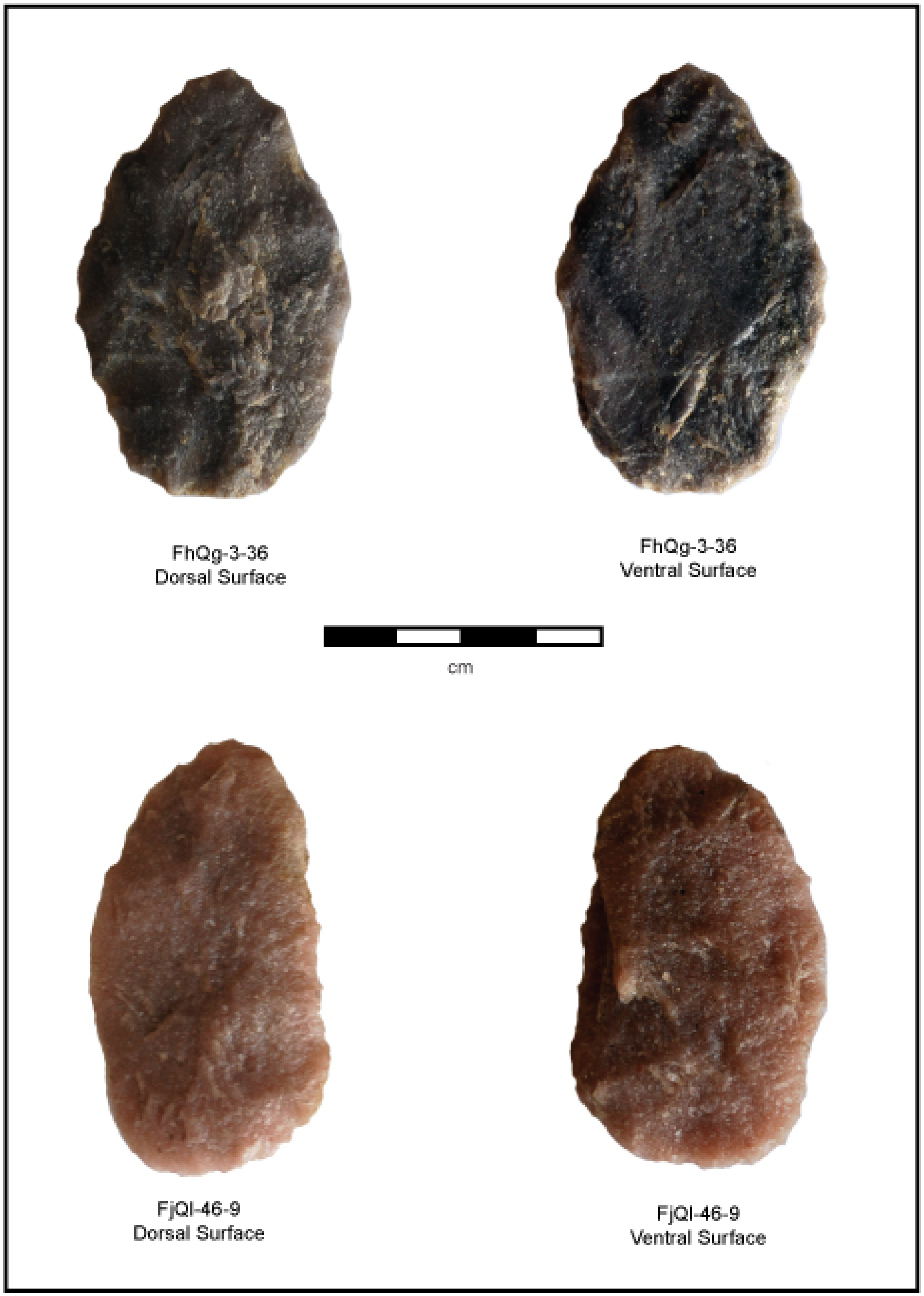

Plate 6: Complete Embarras Bipoints

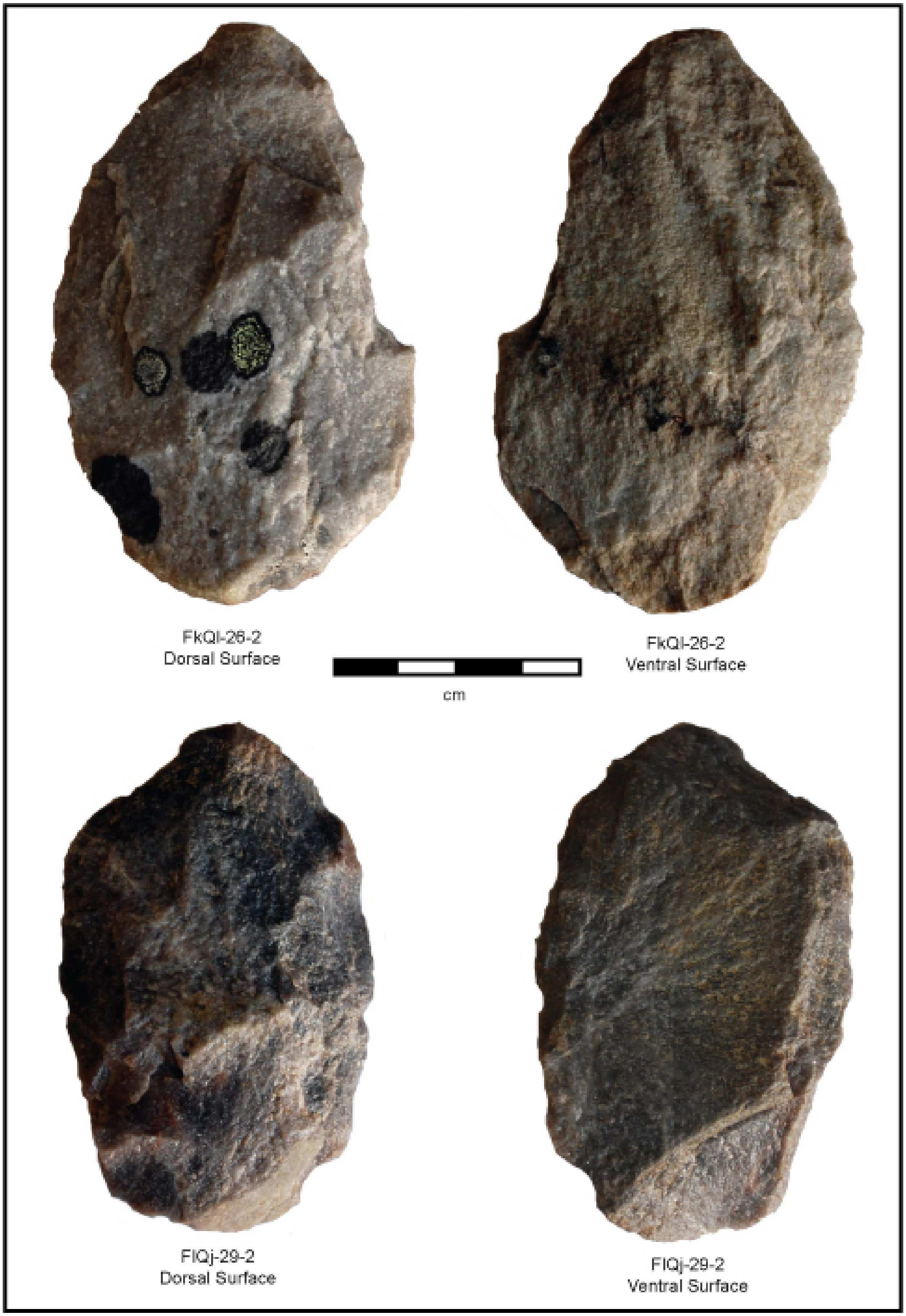

Plate 7: Complete Embarras Bipoints

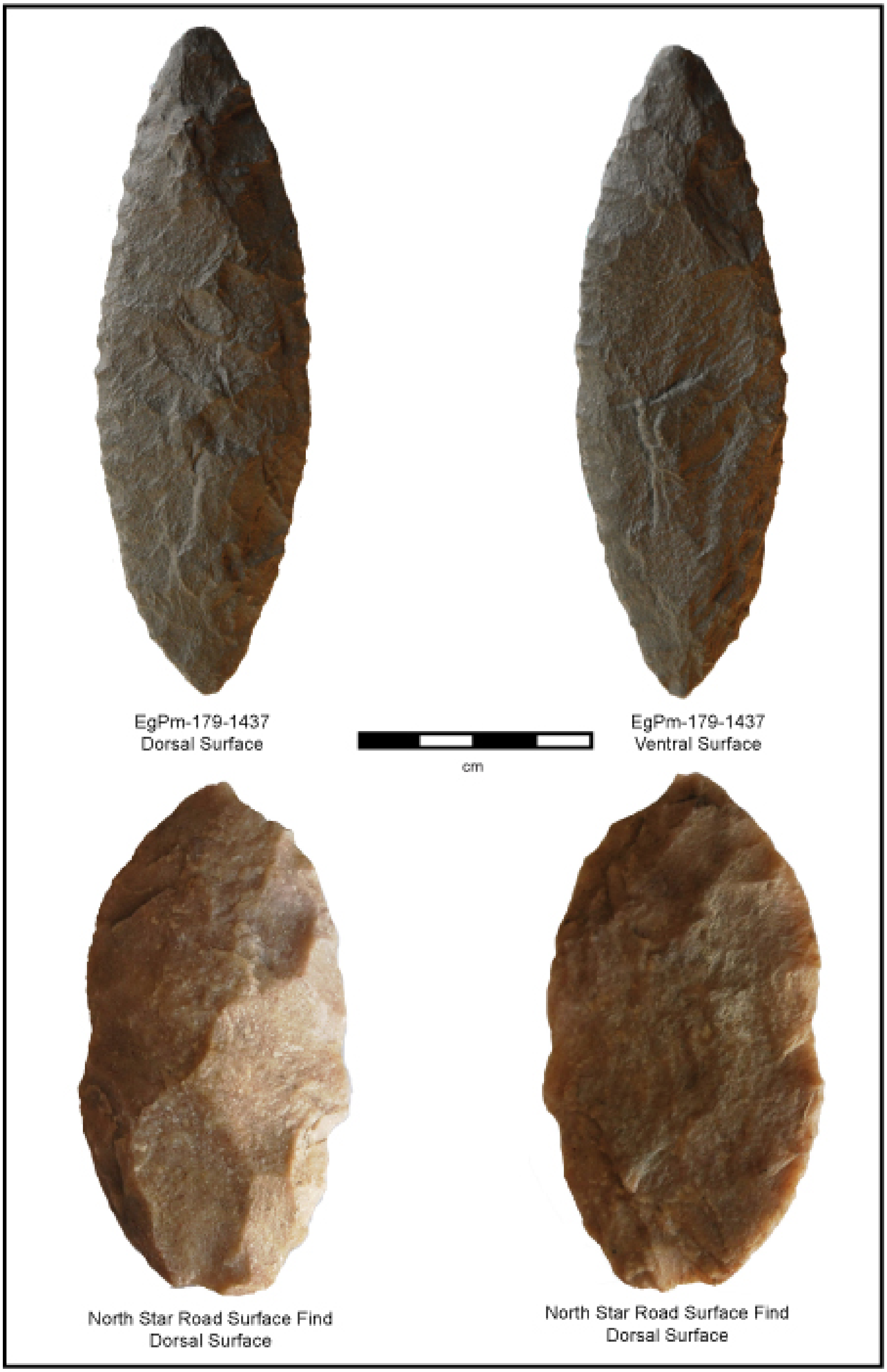

Plate 8: Complete Embarras Bipoints

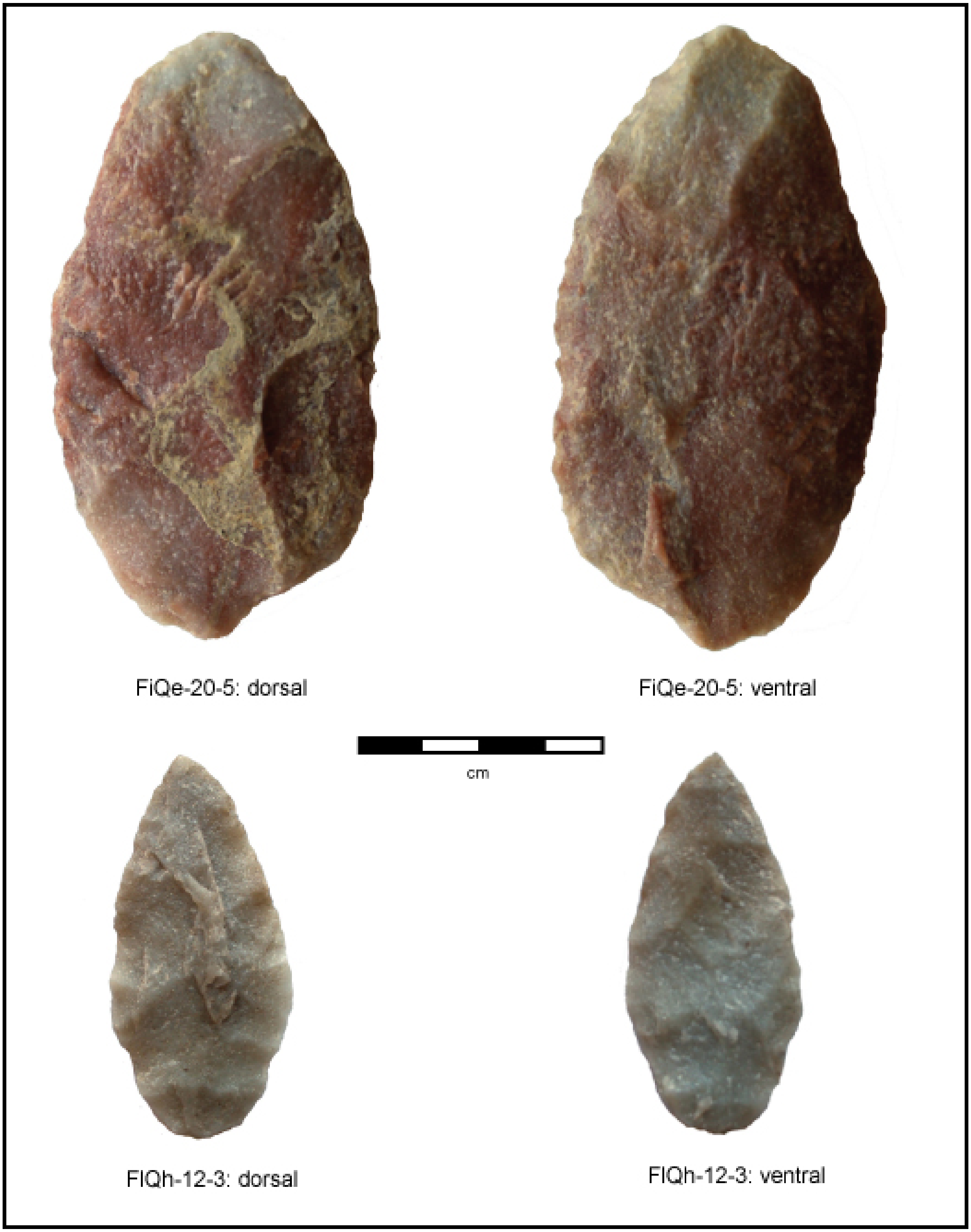

Figure 9: Complete Embarras Bipoints

FlQi-3-175: Dorsal

no picture

FlQi-3-175: Ventral

cm

FgQf-180: dorsal

FgQf-180: ventral

Plate 10: Complete Embarras Bipoints

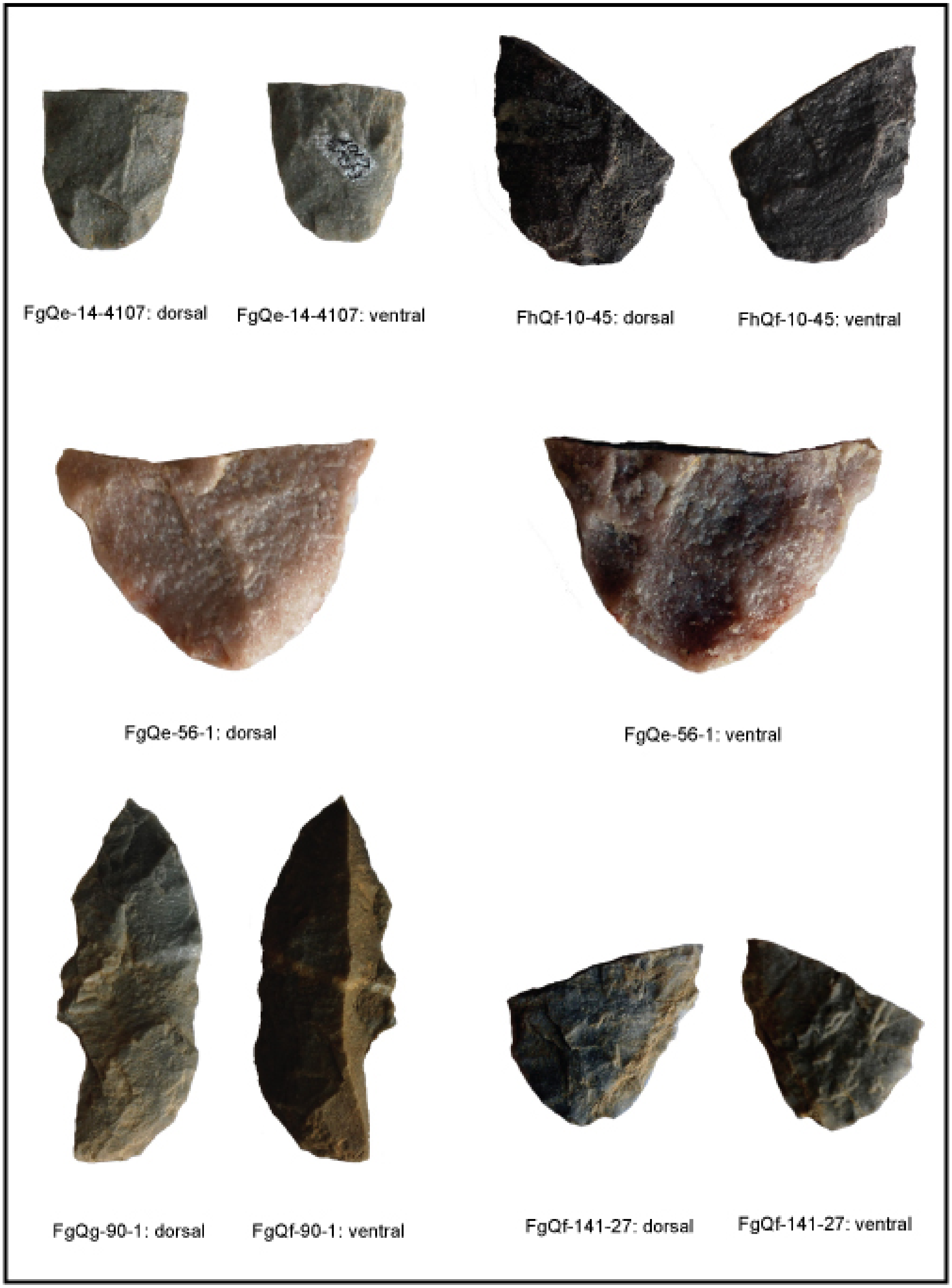

Plate 11: Broken Embarras Bipoints

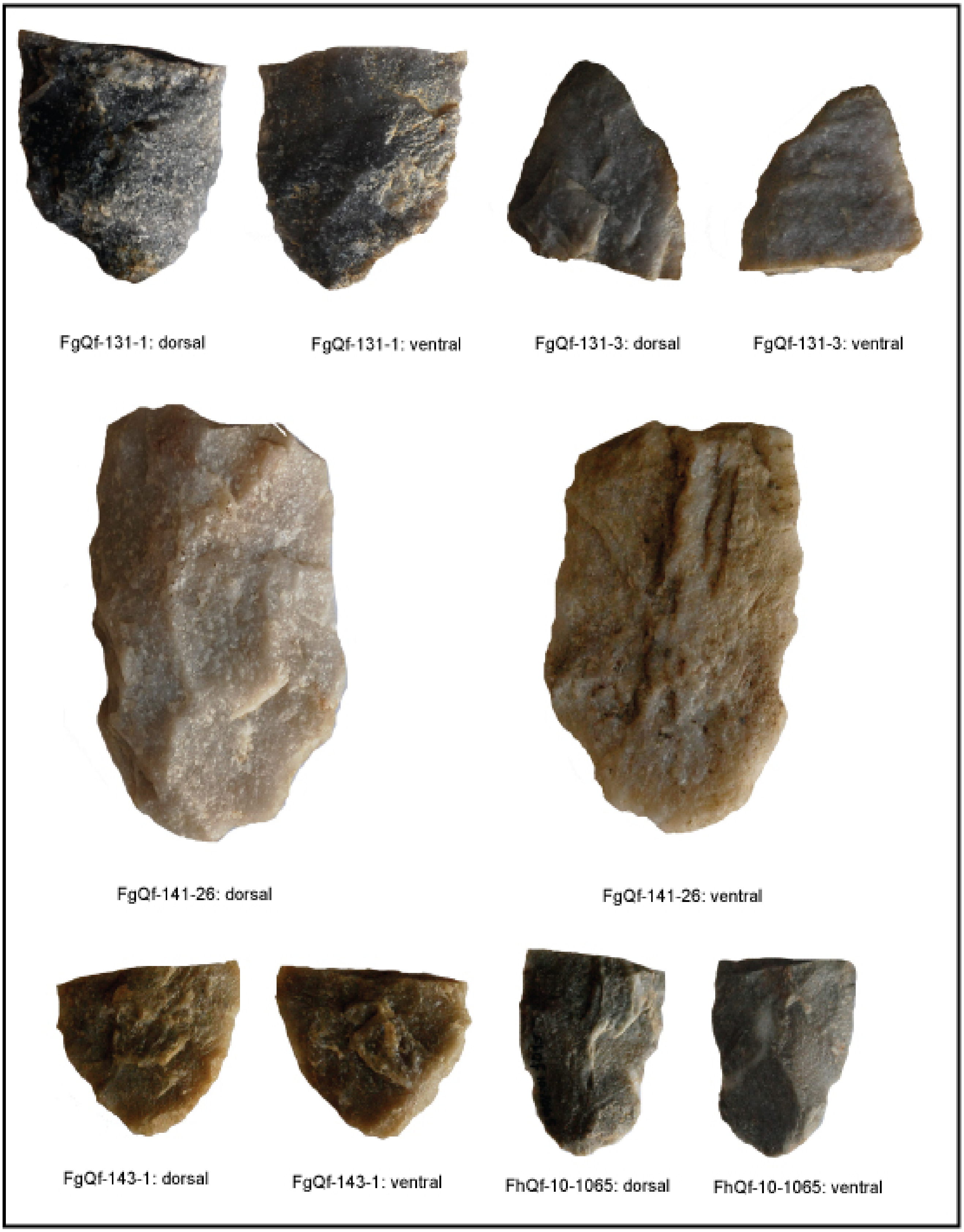

Plate 12: Broken Embarras Bipoints

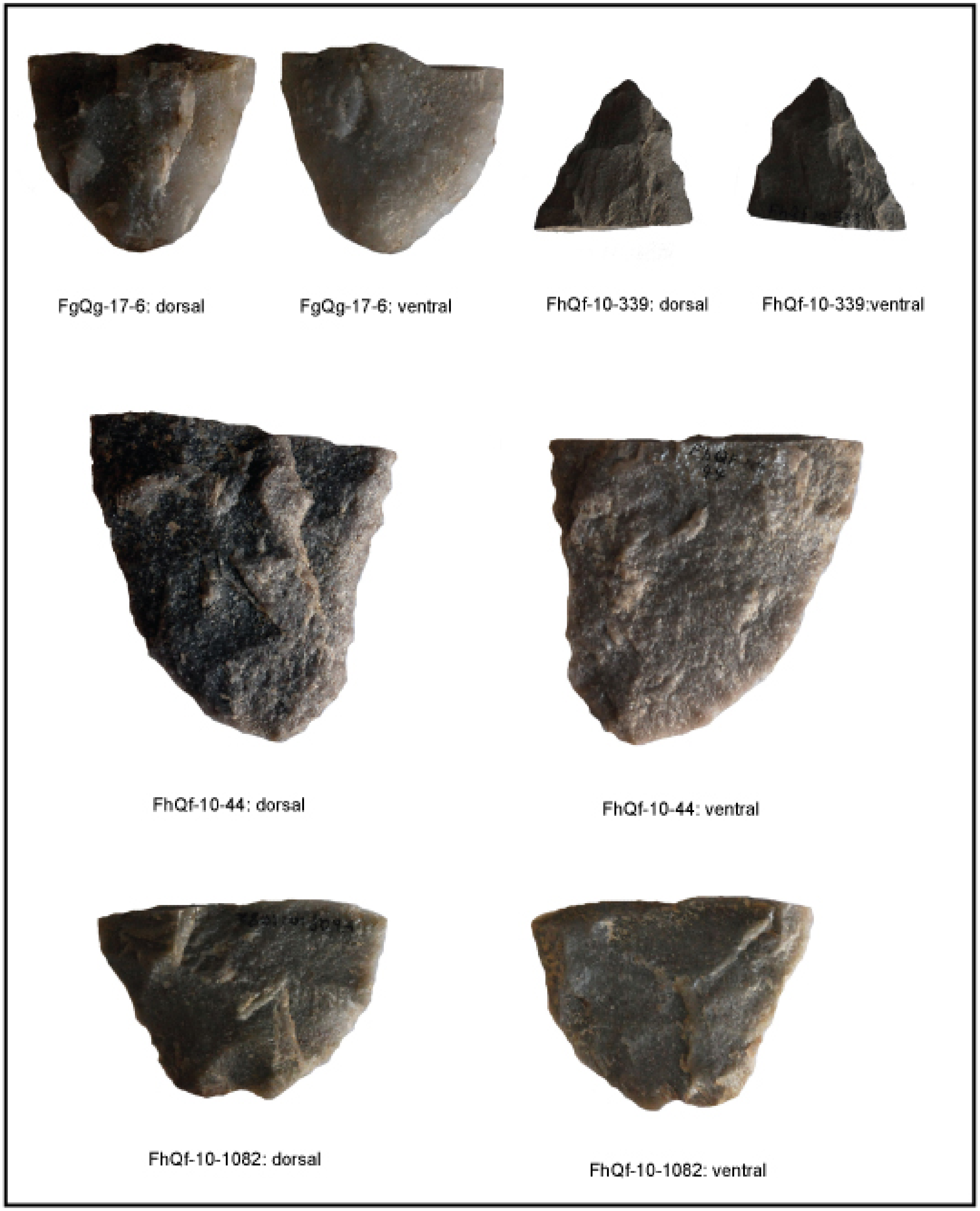

Plate 13: Broken Embarras Bipoints

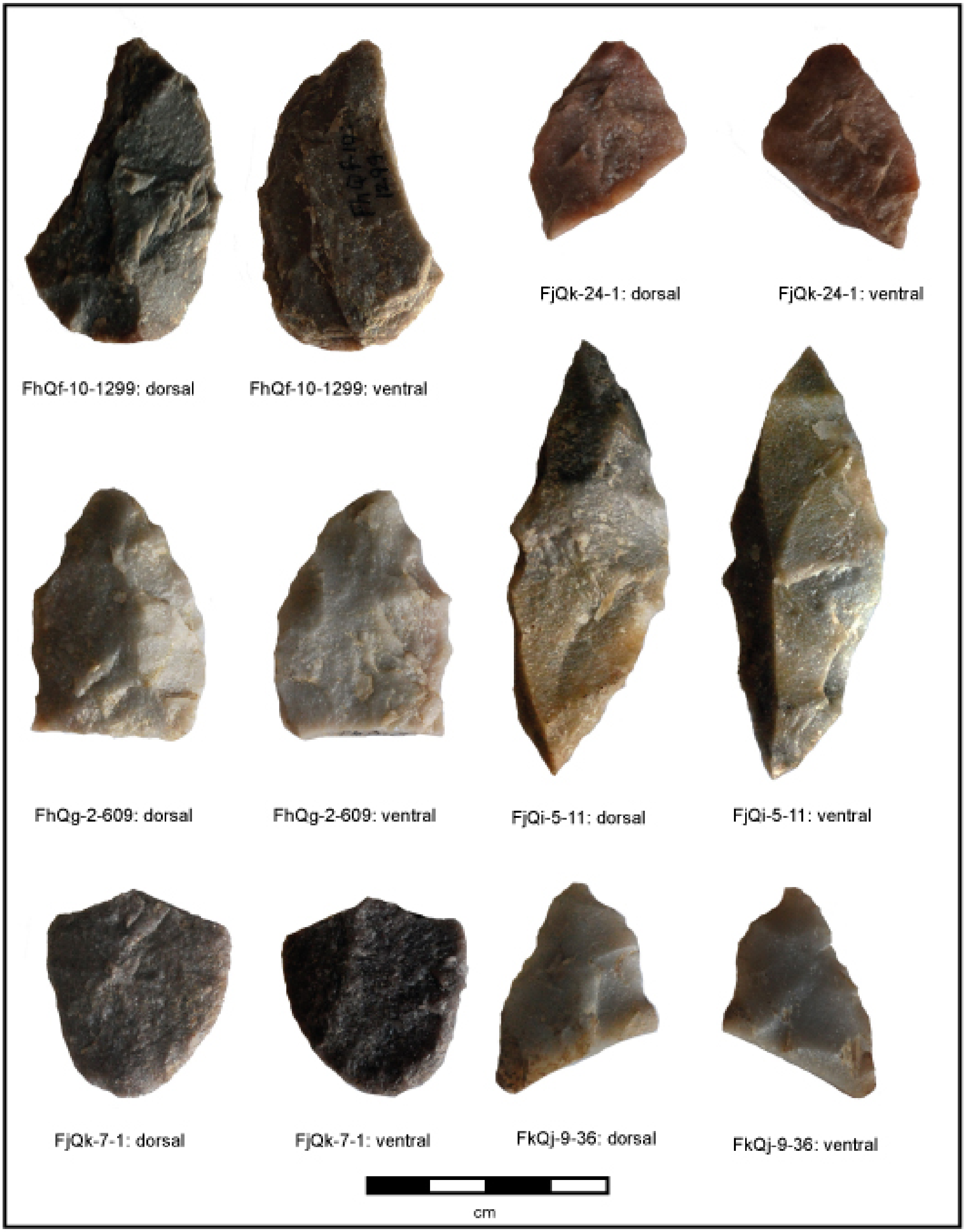

Plate 14: Broken Embarras Bipoints

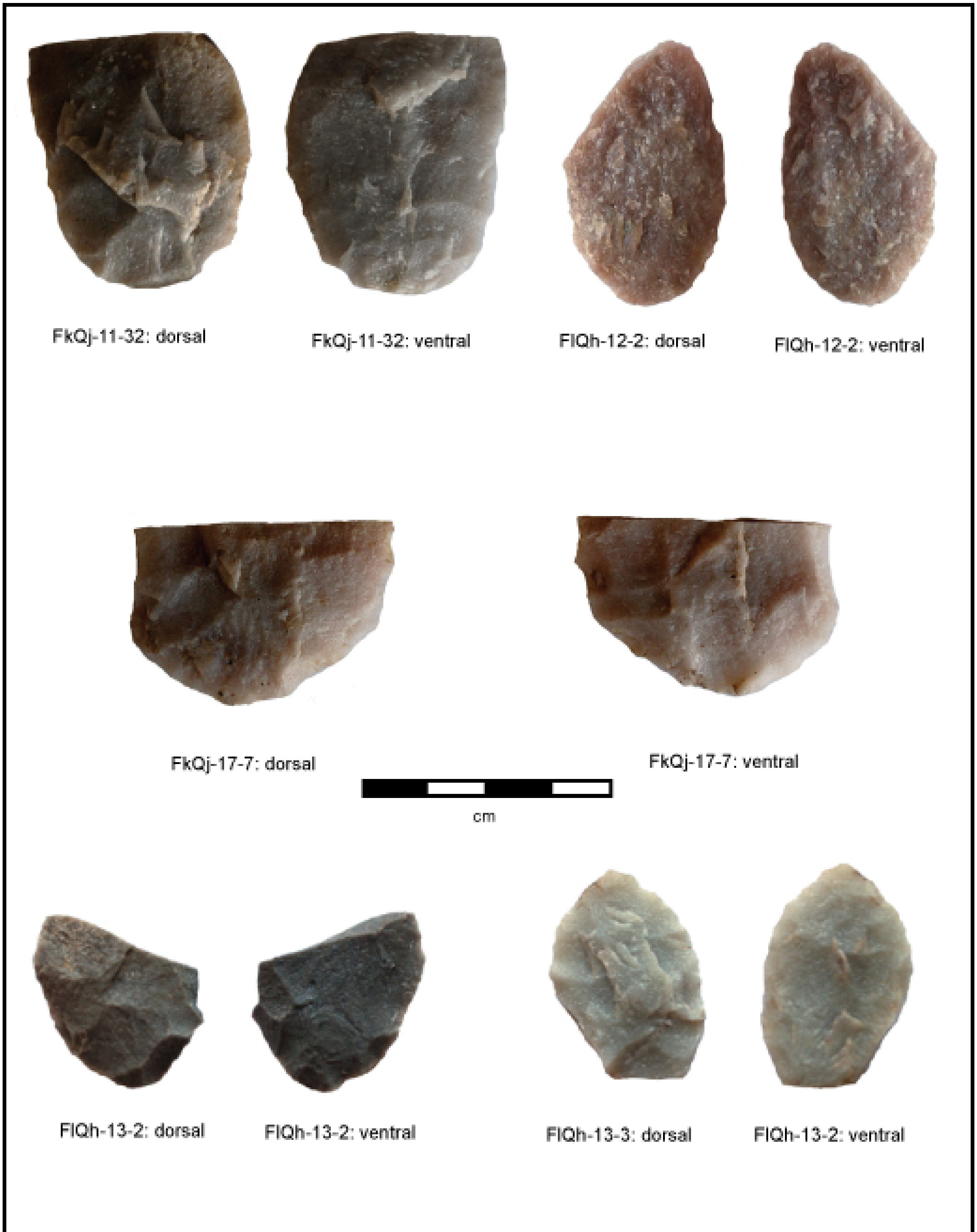

Plate 15: Broken Embarras Bipoints

FkQl-14-13: dorsal

FkQl-14-13: ventral

FlQh-12-1: dorsal

FlQh-12-1: ventral

FlQj-16-12:dorsal

FlQj-16-12: ventral

Plate 16: Broken Embarass Bipoints

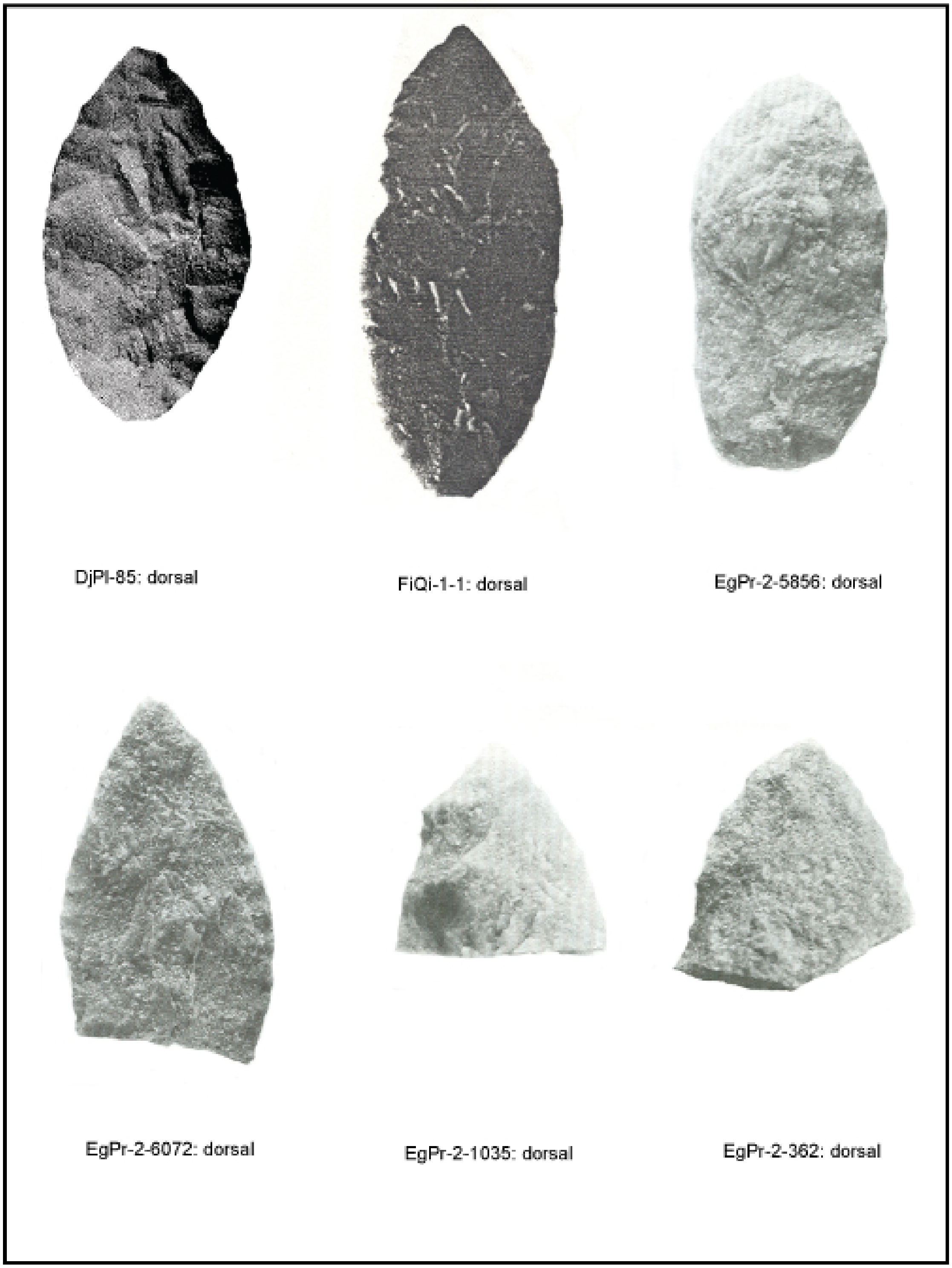

Plate 17: Scanned Images of Embarras Bipoints

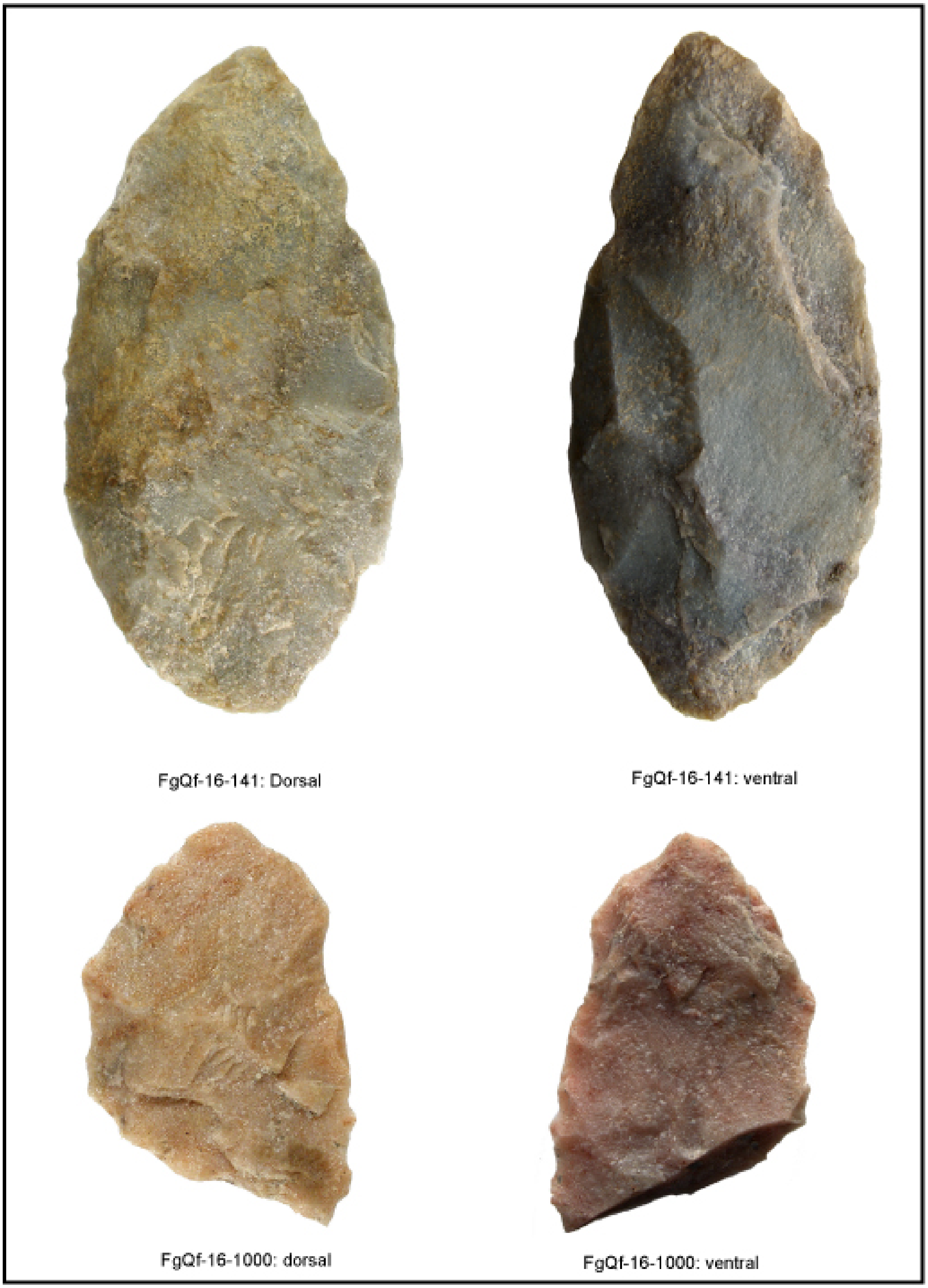

Plate 18: FgQf-16 Embarras Bipoints

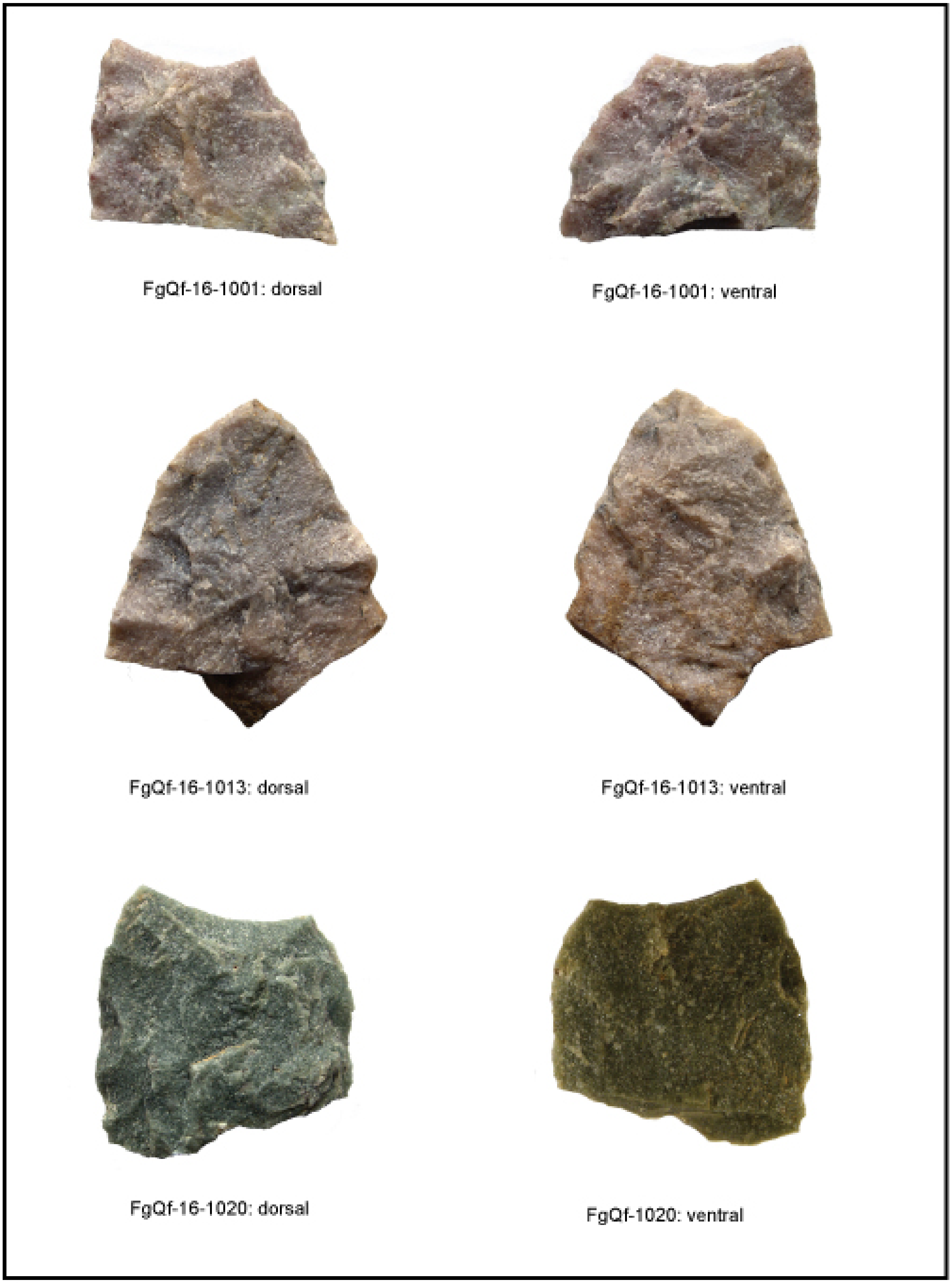

Plate 19: FgQf-16 Embarras Bipoints

FgQf-16-1034: dorsal

FgQf-16-1034: ventral

FgQf-16-2270: dorsal

FgQf-16-2270: ventral

Plate 20: FgQf-16 Embarras Bipoints

IgOg-2: half size

FiQq-8: half size

Fond du Lac: half size

IfPo-4

FdPe-4

Plate 21: Archaeological Examples of Possible Embarras Bipoints

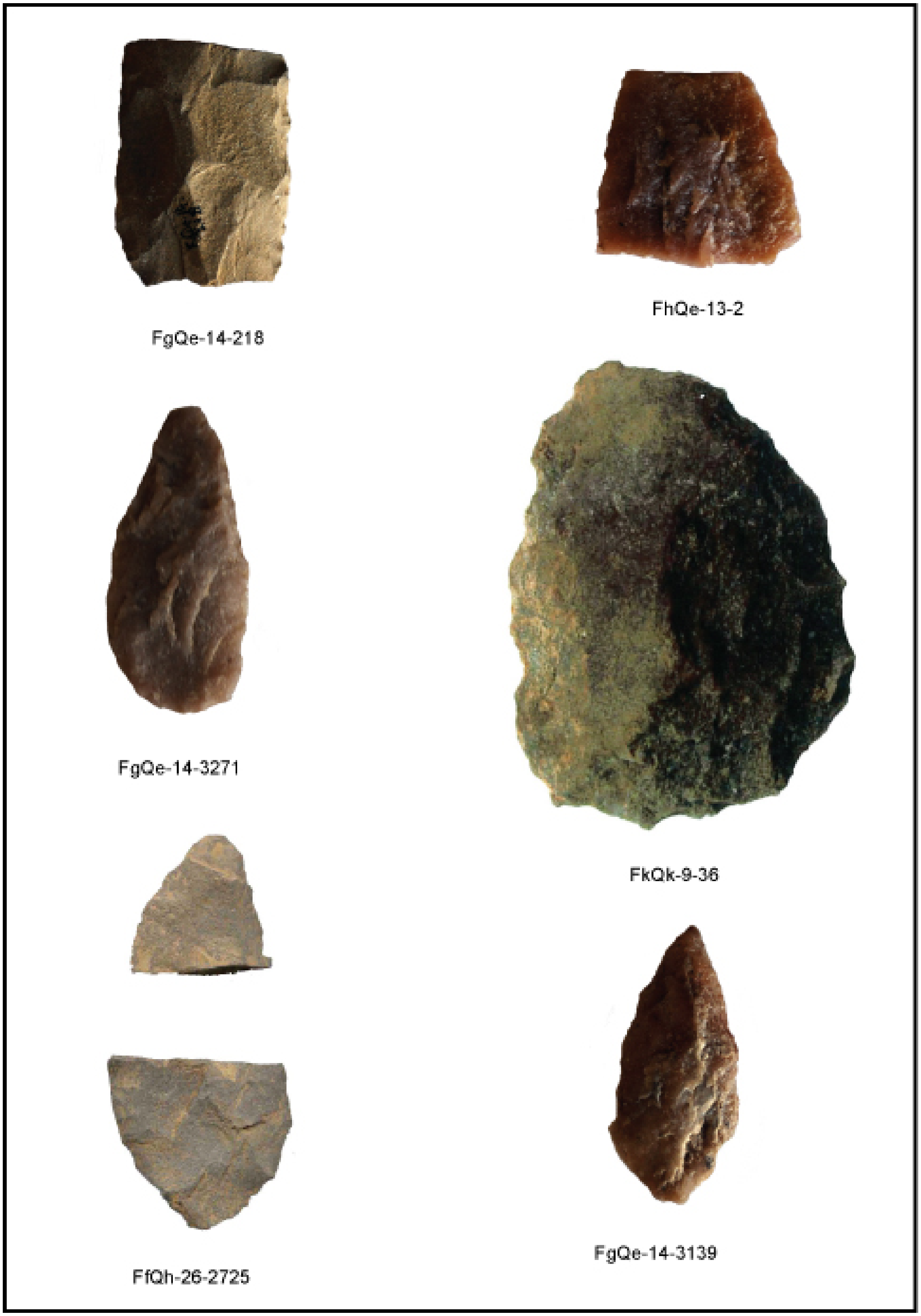

Plate 22: Archaeological Examples of Possible Embarras Bipoints

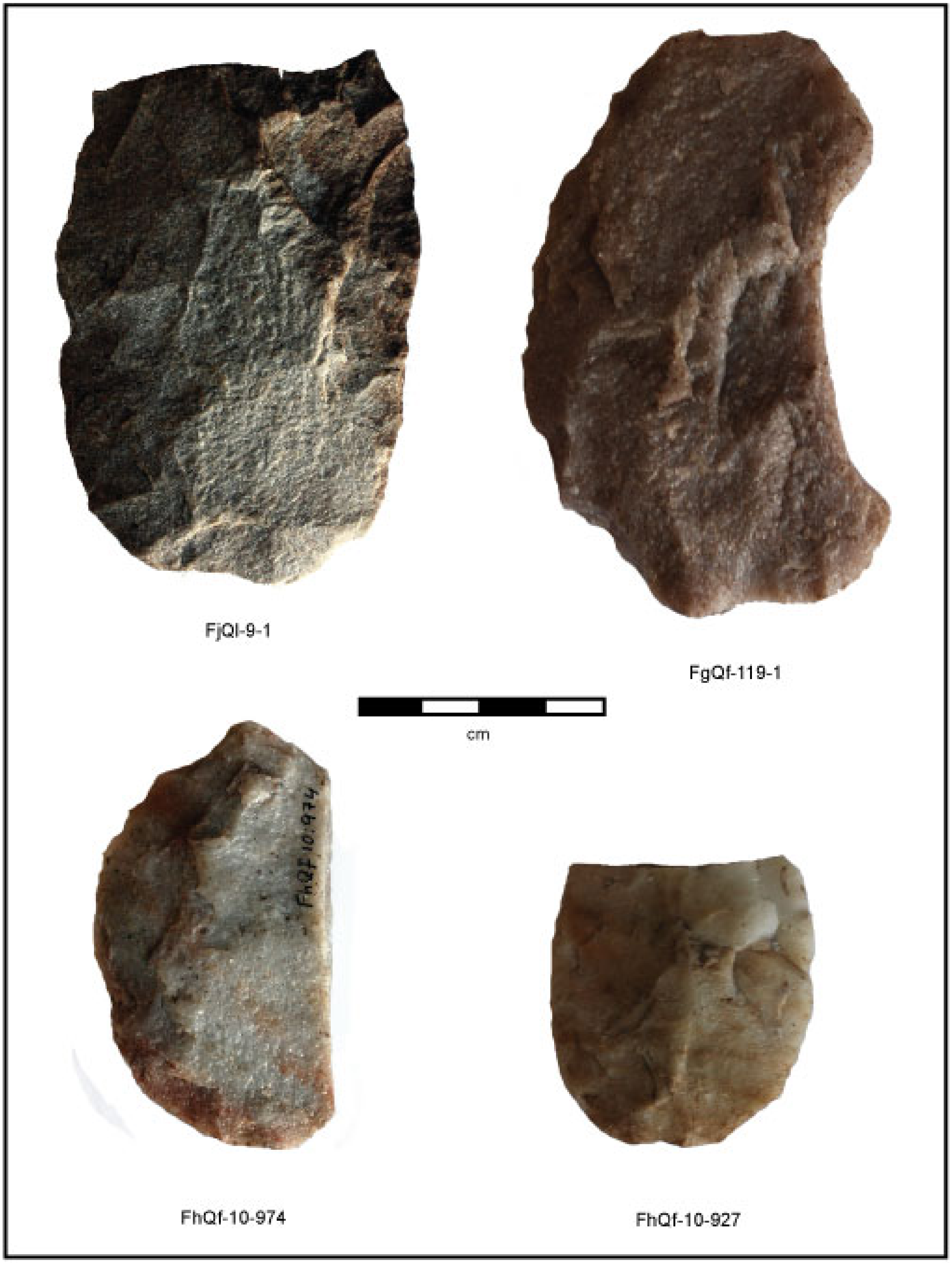

Plate 23: Large Quartzite Bifaces

FiQm-13-1

FlQi-11-1

FhQe-18-2

FhQf-10-1251

Plate 24: Archaeological Example of Bifacial Knives found within Study Area

Plate 25: Examples of Reverse Unifaces from FgQf-16

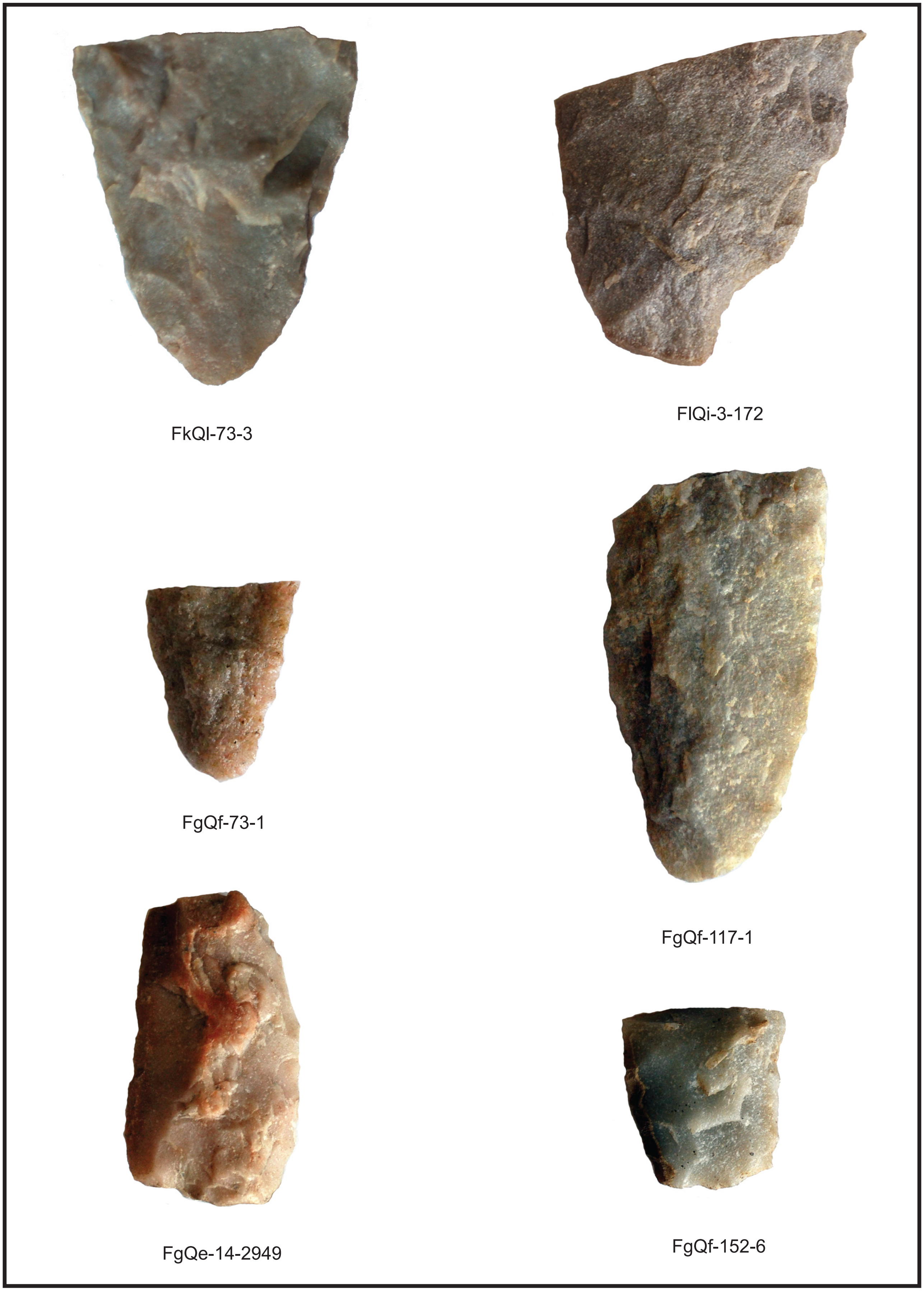

Plate 26: Archaeological Examples of Erith Knives from Study Area

FgQf-180

FhQf-10-910

FgQe-60-1

FhQf-10-327

FhQf-10-7

FgQe-16-383

Plate 27: Archaeological Examples of Lovett Unifaces from Study Area

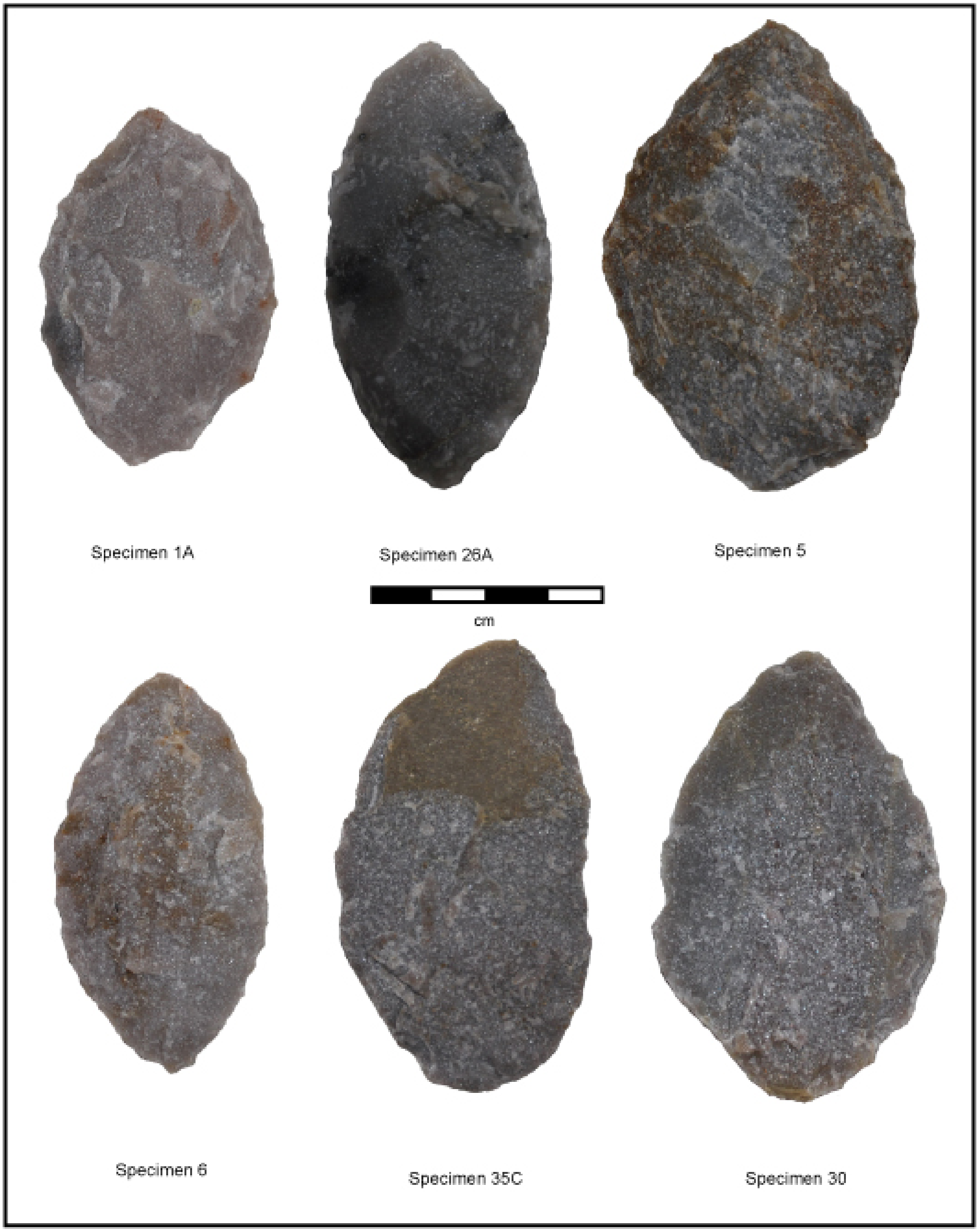

Plate 28: Replicated Embarras Bipoints

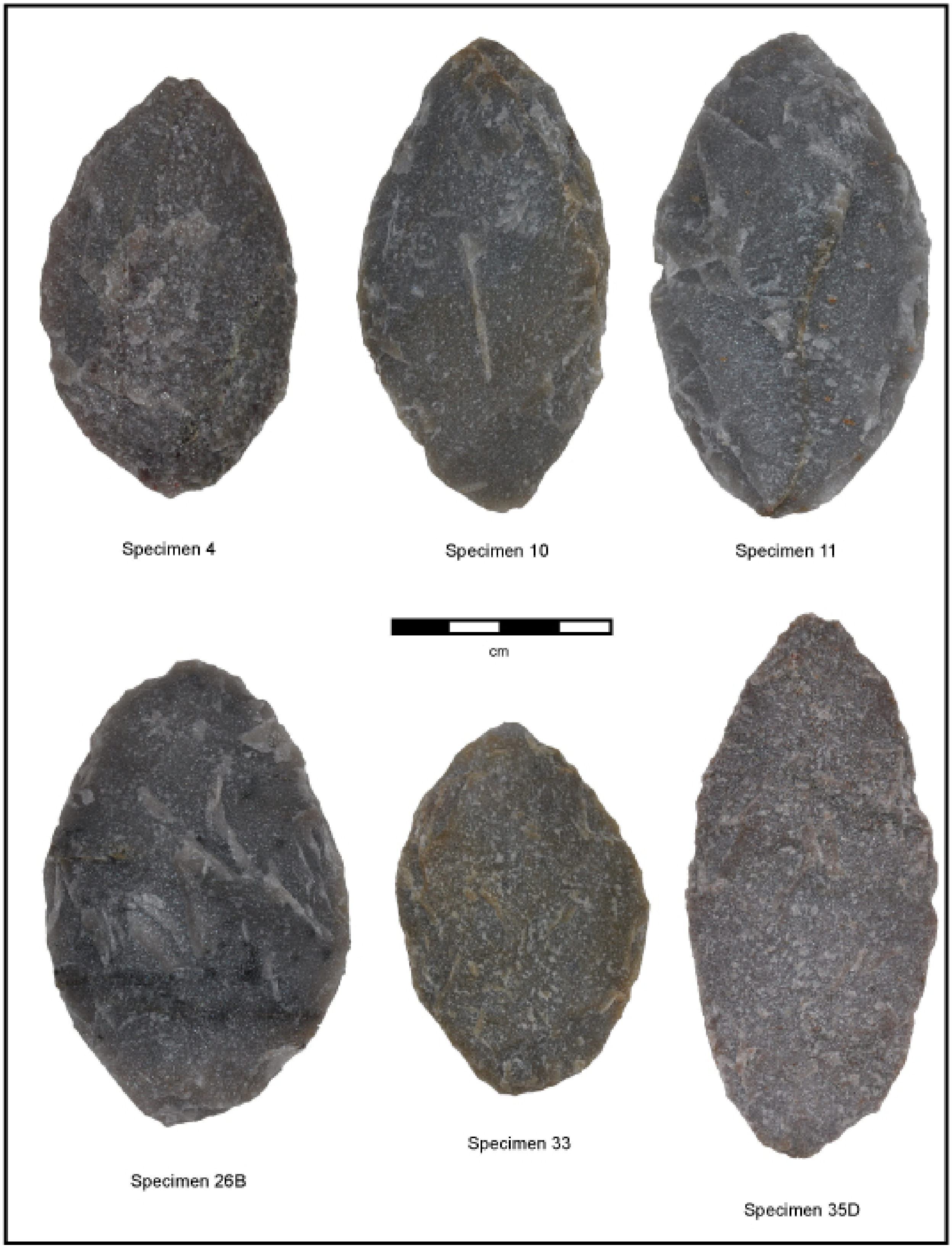

Plate 29: Replicated Embarras Bipoints

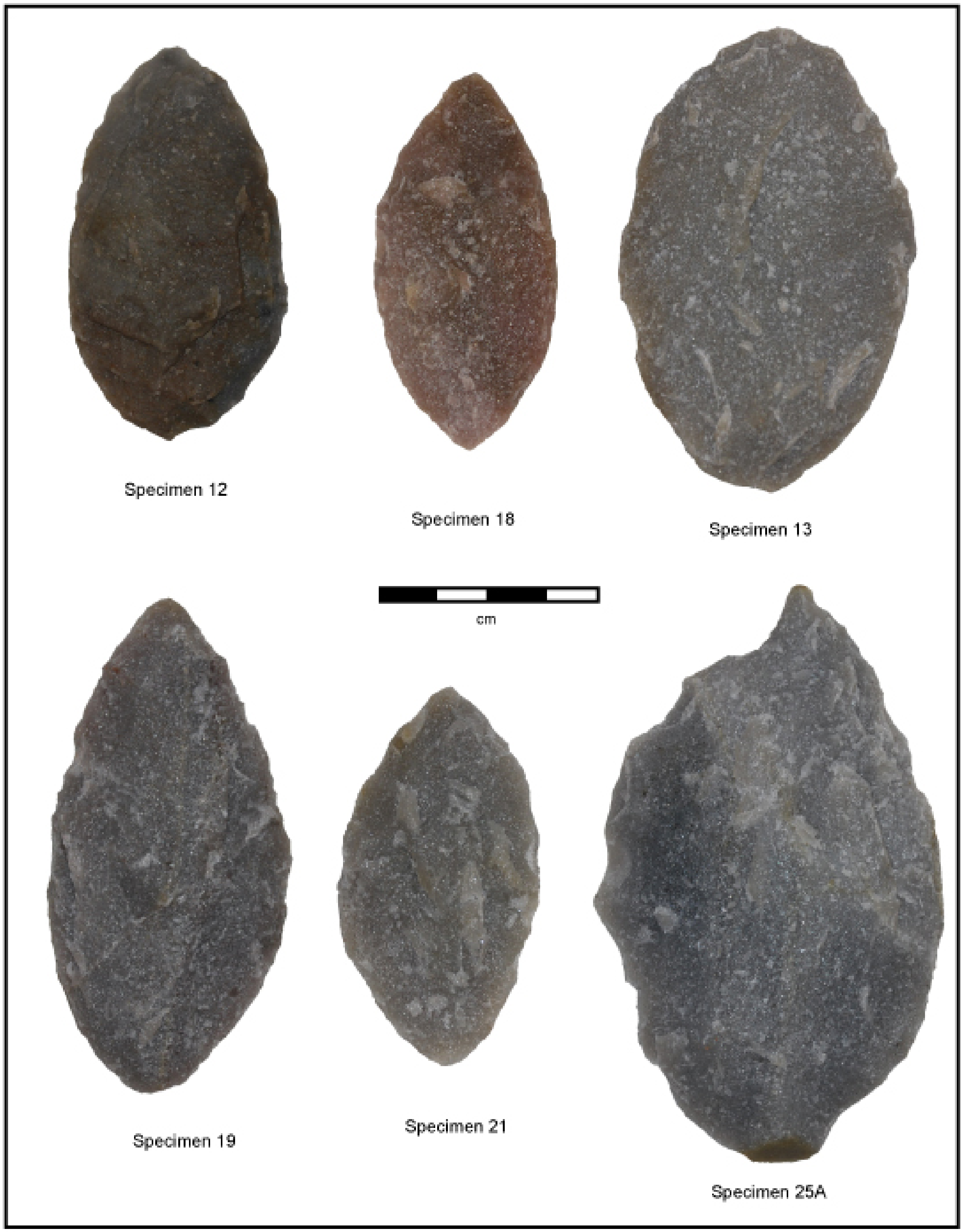

Plate 30: Replicated Embarras Bipoints